L505

Patient monitor user manual

Technology that doesn't miss a beat

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Preface

Thank you for using our Multi-parameter Monitor.

In order to enable you to skillfully operate Multi-parameter Monitor as soon as possible, we provide this user's manual with delivery. When you install and use this instrument for the first time, it is imperative that you read carefully all the information that accompanies this instrument.

Based on the need to improve the performance and reliability of the parts and the whole instrument, we sometimes will make some amendments to the instrument (including the hardware and software). As a result, there might be cases of discrepancies between the manual and the actual situation of products. When such discrepancies occur, we will try our best to amend or add materials. Your comments and suggestions are welcome.

Statement

This manual contains exclusive information protected by copyright laws and we reserve its copyright. Without written approval, no parts of this manual shall be photocopied, Xeroxed or translated into other languages.

The contents contained in this manual are subject to amendments without notification.

Liabilities of the Manufacturer

Only under the following circumstances will our company be responsible for the safety, reliability and performance of the instrument.

- All the installation, expansion, readjustment, renovation or repairs are conducted by the personnel certified by our company.
- The electrical safety status at the installation site of the instrument conforms to the national standards;
- The instrument is used in accordance with the operation procedures.

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Chapter 1 General Introduction

1.1 Intended use

Multi-Parameters Patient Monitor is used to monitor patient's physiological parameters such as ECG、RESP、SPO2、NIBP、IBP、TEMP and EtCO2 continuously，in dynamic and long time. Its intended to be used in various hospital rooms such as Coronary Care Unit，Intensive Care Unit，Neonatal Intensive Care Unit and Operating Room to provide additional information to medical and nursing staff about the physiological condition of the patient.

1.2 About this Manual

This user's manual consists of the following chapters:

Chapter 1 gives an introduction to the content and the specific signs of this manual, the main features and appearance of the monitor, the basic operations of various buttons, the meanings of the signs on the monitor, specifications and performance criteria of the monitor, the ambient requirements for the working and storage of the monitor.

Chapter 2 gives important safety notes **Please do read this chapter before using the monitor!**

Chapter 3 gives an introduction to the preparatory steps before using the monitor.

Chapter 4 provides general operation instruction for the monitor, including illustrations of the screen display, normal selection for soft button on screen, details for entry of patient data and trend maps, also.

Chapter 5 gives details of specific parameter measurement, preparatory steps, cables or probes connection, setup of parameters, maintenance and cleaning of equipments and sensors.

Chapter 6 gives detailed description of system alarm, including level and mode of alarm, default setting and changing procedure of alarm parameters, prompt of specific alarms, and the general operation to carry out when an alarm occurs.

Chapter 7 gives detailed description of print function.

Chapter 8 gives general maintenance and cleaning methods of the monitor and its parts.

Signs in this manual:

Warning: Means it must be strictly followed so as to prevent the operator or the patient from being harmed.

Attention: Means it must be followed so as not to damage the instrument.

Note: Important information or indications regarding the operation or use.

1.3 Brief Introduction to the Monitor

Multi-parameter Monitor is the latest product developed with years' experience of the monitor design and manufacturing to adapt to the various requirements of present hospitals. It has features as follows:

✱ Multiple measuring functions

3-lead, 7-lead ECG/HR, RESP, Dual TEMP, SpO_2/Pulse, NIBP, dual IBP,$EtCO_2$ are optional.

- Complete built-in module design ensures stable and reliable performance
- Unique all-lead ECG on-one-screen display, which can facilitate the diagnosis and analysis of cardiac disease
- Can store the trend data for as long as 96 hours and has the function of displaying trend data and trend maps
- Function of alarm event reviewing, can store 500 pieces of alarm events
- Function of NIBP measurement reviewing, can store 500 pieces of NIBP measurement data
- Function of reviewing 10 minute one important lead's EGC waveform
- Built-in recorder is optional and it has the functions of real-time recording, printout of the present screen and the triggering of print by alarm
- Parameter display with capital character
- Optional function of Calculator of drug concentration
- Optional function of Display of oxyCRG
- 12.1″ or 10.4″ authentic color high brightness TFT LCD monitor
- Portable design, stylish and convenient
- Rechargeable maintenance-free battery, can continue working when AC power is off
- Can be linked with the central unit provided to realize centralized monitoring
- Is resistant to high-frequency electrotome and is protected against defibrillation effects

1.4 Appearance and Structure of the Monitor

1-4-1 The appearance of multi-parameter monitor

Note: The AC input at the back panel of the Multi-parameter Monitor can be connected with the 100V~240V AC Power by electrical wires supplied with this instrument.

1.5 Sockets

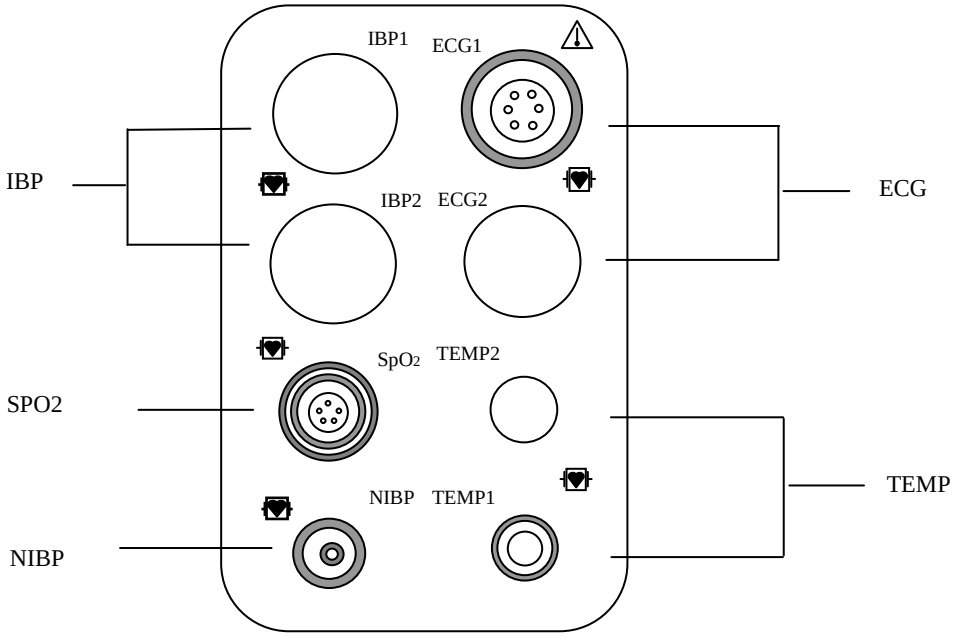


Fig. 1-5-1 Various sockets on the panel at the right side (full)

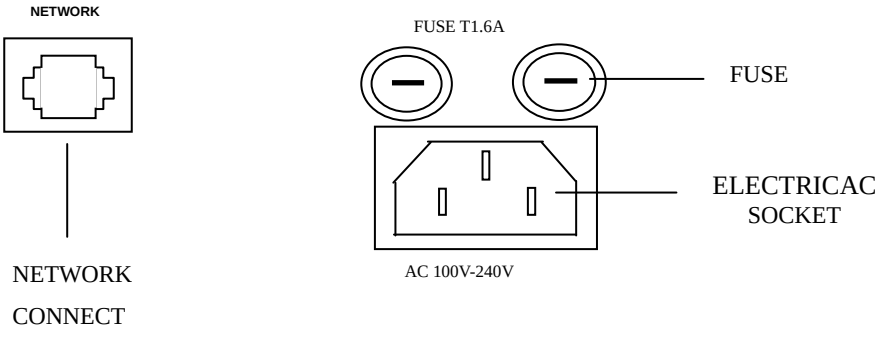


Fig. 1-5-2 Various sockets on the panel at the back

Note: The Network Connector choose RJ45 socket and be used for connection with the central monitoring system provided.
The RS-232 Serial Port is only used for the maintenance and upgrade of monitor.

Warning: The sensor cable sockets on Multi-parameter Monitor can only be connected with the sensor cables supplied with this instrument and no other cables shall be used.

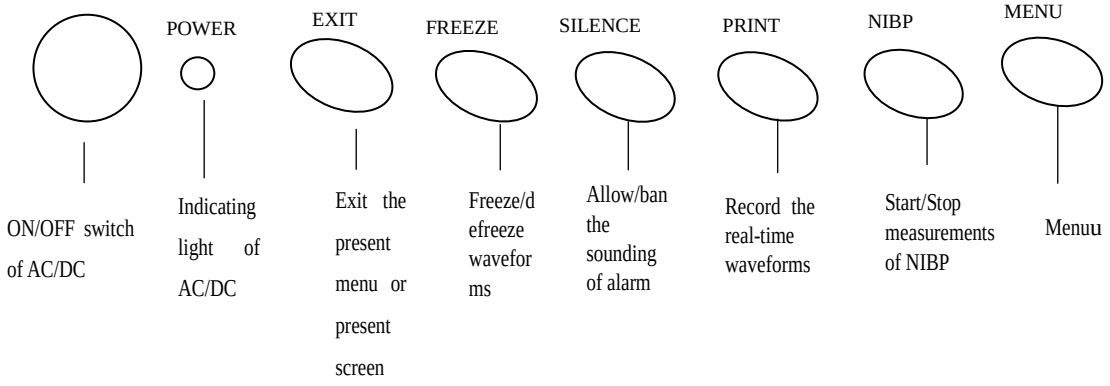
Notes on the signs on the right-side panel

Signs	Notes on the signs
ECG 1	Short for “Electrocardiogram” channel 1.
ECG 2	Short for “Electrocardiogram” channel 2.
	CF Type Sign for the Prevention of Defibrillation (Refer to IEC 601-1:1988) Here it means the measurement design for ECG parameters of this monitor features special protection against electrical shock (especially when there is allowed leaking current) and has protection of defibrillation.
	BF type equipment flag (Refer to IEC 601-1-1988) This flag indicate the application part is BF type, Design for special protection against electrical shock (especially when there is allowed leaking current) and has protection lf defibrillation. It means BF type sign for the equipment has protection of defibrillation.
	Attention! Please refer to the document supplied with this instrument (this manual)!
	Dangerous voltage
	AC power
	Non-ionizing radiation
SpO_2	Short for “Pulse Oxygen Saturation”
TEMP 1	Short for “Temperature” channel 1
TEMP 2	Short for “Temperature” channel 2

IBP 1	Short for “Invasive Blood Pressure” channel 1
IBP 2	Short for “Invasive Blood Pressure” channel 2
NIBP	Short for “Non-invasive Blood Pressure”

Note: The two channels of ECG1, ECG2 for ECG are used for the realization of the input for all-lead electrocardiogram; plug the 5-lead ECG cable with limb lead (RA, LA, C, RL, LL) into ECG1 (Channel 1), and the chest lead cable (C1, C2, C3, C5, C6) into ECG2 (Channel 2), and at this moment, the 12-lead (Full-lead) ECG monitoring can be realized. In case only 7-lead monitoring is needed, then it is only necessary to plug the 5-lead ECG cable of the limb lead (RA, LA, C, RL, LL) into ECG1 (Channel 1). Be careful not to plug it into ECG2 (Channel 2).

1.6 Function Buttons and Trim Knob on the Front Panel



Turn the Trim Knob to move the cursor (selection box) for selection of the items on the menu or the soft buttons on the screen; press the Trim Knob can confirm the present selection.

Fig. 1-6-1 Function Buttons and Trim Knob on the Front Panel

1.6.1 The Signs and Operation Instructions Within the Function Button Zone

Signs	Notes on the signs	Operation instructions of function buttons
power	Indicating light of AC/DC	When the monitor is connected to the AC power, this indicating light is green (it is unrelated to the ON/OFF state of the monitor), and, at this moment, the rechargeable maintenance-free battery is in the state of recharging. When the monitor is not connected to AC power and the DC battery is used as the power source, this indicating light is orange
⏻/⊙	Power button	Press this button once and the monitor starts up. Repress this button, then the monitor is switched off.
EXIT	Exit	Press this button once to exit the present menu or the present screen. In the system menu, trend screen and parameters setup screen, there are selections of <**Return**> or <**Exit**>, and this button is its short-cut key.
NIBP	Switching type button Begin andStop the measurement of NIBP	Press this button to start the air pump and begin the measurement of NIBP. Again press this button to stop the air pump and begin the measurement of NIBP.
SILENGE	Switching type button	Press this button to stop sound alarm (when the alarm is on, the sound is not produced). Repress this button once to initiate the sound alarm (When sending out alarm, the system produces a sound).
FREEZE	Switching type button	Press this button once to freeze the waveform. Repress this button to defreeze the waveform.
PRINT	Switching type Real-time recording	Press this button to begin real-time recording. Repress this button to stop real-time recording.
MENU	MENU	press the Trim Knob can confirm the present selection.

1.6.2 Basic Operations

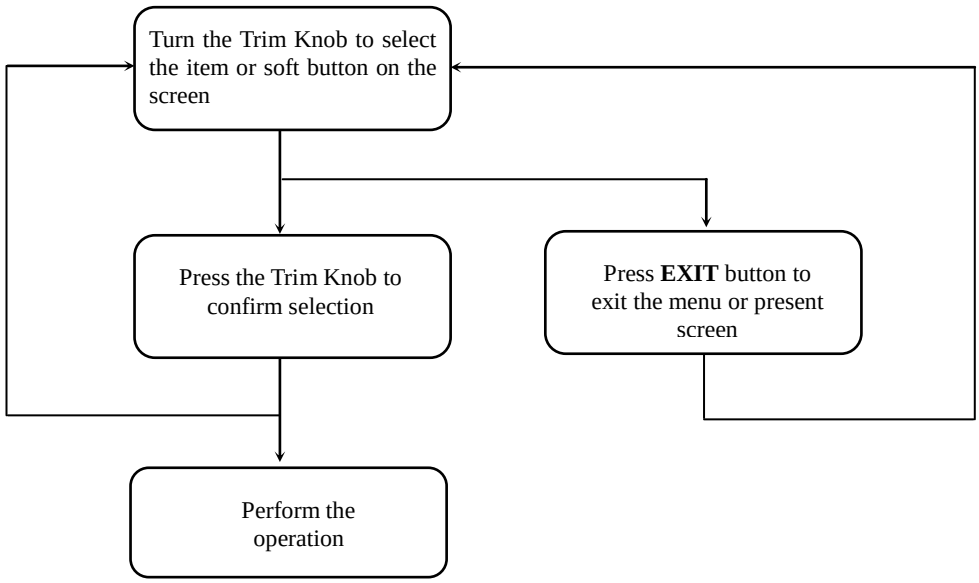

Turn the Trim Knob to select the item or soft button on the screen
Press the Trim Knob to confirm selection
Press **EXIT** button to exit the menu or present screen
Perform the operation

Fig. 1-6-2 Flow chart of basic operations

Note: The system menu is located at the left bottom corner (refer to Fig.4-1). By operating the Trim Knob in the above flow chart, select the items or make them spring out, and for detailed item selection, please refer to Chapter 4.

1.7 Specifications and Performance Criteria of the Monitor

1.7.1 Classification

▭ Instrument of Class I powered by external power and instrument with internal power supply

▭ BF, CF type equipment, among which the measuring parts of ECG, TEMP, RESP and IBP belong to CF type, and the measuring parts of SpO_2 and NIBP belong to CF type, too.

▭ Ordinary equipment (sealed equipment not protected against permeating fluid)

▭ For the methods of disinfections and sterilization, refer to **Chapter 8** of this manual

▭ Equipment of continuous running

1.7.2 Specifications

Size and Weight

Name of the monitor	Multi-parameter Monitor
Size	318mm×264mm×152mm
Weight	4.5Kg

System output

Display type	12.1″ or 10.4″ LCD color display screen, with a resolution of 800×600 or higher
Interface with central unit	Network port

Power supply

Power Voltage	AC 100V~240V 50/60Hz
Power Input	≤ 70VA
Fuse	T1.6AL 250V
Safety class	Category I, CF Type

Battery

Type	Rechargeable Lead acid cell, 12V/2.0AH
Charge time	≤ 6 hours
Working hours when charged fully	≥ 30min when using normally

Environment

Ambient Temperature	Working 0~+40ºC Transportation and storage –20~+50ºC
Relative humidity	Working ≤ 85% Transportation and storage ≤ 93%
Atmospheric pressure	Working 860~1060 hPa Transportation and storage 500~1060 hPa

ECG

Lead Mode	1. 5-leads ECG input 2. 3-leads ECG input 3. 10-leads ECG input
Lead selection	1. I, II, III, aVR, aVL, aVF, V- 2. I, II, III 3. I, II, III, aVR, aVL, aVF, V1~V6
Gain	2.5mm/mV, 5mm/mV, 10mm/mV, 20mm/mV, 40mm/mV
Input impedance	≥ 5.0 Mohm (d.c. ~ 60 Hz)
CMRR	DIAG ≥85dB MON ≥105dB OPS ≥105dB
Frequency response	DIAG 0.05~75Hz MON 0.5~25Hz OPS 1~15Hz
Electrode offset potential	±300 mV d.c. → ±600mV d.c.
Leakage Current	<10 uA
ECG signal range	±6.0 mV
Baseline recovery	<5 s After Defi. (MON or OPS mode)
Insulation	Breakdown Voltage 4000VAC 50Hz/60Hz
Indication of electrode separation	Available
Sweep speed	12.5mm/s, 25mm/s, 50mm/s

HR Measuring and Alarm

Range	10~300 bpm
Refreshing time	Per pulse
Resolution	1 bpm
Accuracy	±1% or ±1 bpm, whichever is greater

Alarm range	10~300 bpm, continuously adjustable between high limit and low limit
Alarm indication	Sound and light alarming

NIBP

Way of measurement	Automatic oscillometry		
Range of measurement	Adult	SYS	30~270mmHg
		DIA	10~220 mmHg
		MEAN	20~235 mmHg
	Child	SYS	30~235 mmHg
		DIA	10~220mmHg
		MEAN	20~225mmHg
	Neonate	SYS	30~135 mmHg
		DIA	10~110 mmHg
		MEAN	20~125 mmHg
Cuff pressure range	0~280 mmHg		
Resolution	1 mmHg		
Pressure Accuracy Static Clinical	±2% or ±3 mmHg, whichever is greater ±5 mmHg average error 8 mmHg standard deviation		
Unit	mmHg, kPa		
Pulse rate measuring range	40 ~ 240 bpm		
Inflation time for cuff	Less than 40 sec. (standard adult cuff)		
Total cycle time	20 to 45 seconds typical (dependent on heart rate and motion artifact)		
Intervals for cycle measurement time	1,2,3,4,5,10,15,20,30,45,60,90 minutes 2,4,8 hours		
Overpressure Protection Adult Child Neonatal	Hardware and software double protections 315±10 mmHg 265±10 mmHg 155±10 mmHg		
Range of alarm	SYS	0~300 mmHg, continuously adjustable between high limit and low limit	

	DIA	0~300 mmHg, continuously adjustable between high limit and low limit
	MEAN	0~300 mmHg, continuously adjustable between high limit and low limit
Alarm indication	Sound and light alarming	
Ways of measurement	Manual，Auto and STAT	

SpO_2

Range of measurement	0~100%
Resolution	1%
Precision	At 70~100%, ± 2% At 35~69%, ± 3% At 0~34%, unspecified
Range of alarm	0~100%, continuously adjustable between high limit and low limit
Alarm indication	Sound and light alarming
Type of sensor	Dual bandwidth light emitting diode
PR: Measuring and alarm Range Resolution Accuracy	25~250 bpm 1 bpm ±2% or ±1 bpm, whichever is greater

IBP

Range of measurement	-45 ~ +300 mmHg
Resolution	1 mmHg
Precision	± 4mmHg or 4% of the reading (select the bigger one of the two)
Sensitivity of transducer	5uV/V/mmHg, 2%
Impedance of transducer	300~3000 Ohm
Bandwidth	d.c. ~ 15Hz
Transducer sites	Arterial Pressure (ART) Pulmonary Artery Pressure (PA) Left Atrium Pressure (LAP) Right Atrium Pressure (RAP) Central Venous Pressure (CVP) Intracranial Pressure (ICP)

Selection of measurement range	ART	0~50mmHg 50~150 mmHg 100~240 mmHg 0~300 mmHg AUTO
	PA CVP LAP RAP ICP	0~20 mmHg 0~30 mmHg 0~50 mmHg 0~80 mmHg AUTO
	(Among them, the AUTO switches automatically at an interval of 10 mmHg so as to ensure the waveform is at the state most suitable for observation)	
Range of alarm	SYS	-10~300 mmHg, continuously adjustable between high limit and low limit
	DIA	-10~300 mmHg, continuously adjustable between high limit and low limit
	MEAN	-10~300 mmHg, continuously adjustable between high limit and low limit
Alarm indication	Sound and light alarm	
Unit	mmHg, kPa	
Insulation resistance	>5000MΩ /1000V	
Breakdown voltage	>4000V AC 50Hz/60Hz	

TEMP

Range of measurement	0.0~50.0ºC
Resolution of display	0.1ºC
Unit	Celsius (ºC), Fahrenheit (ºF)
Precision	±0.1ºC
Connecting cable	Compatible with YSI-400
Range of alarm	0.0~50.0ºC, continuously adjustable between high limit and low limit

Alarm indication	Sound and light alarming

RESP

Method	Impedance between RA-LL (R-F)
Measuring impedance range	0.5 ~3 Ohms
Base line impedance range	500~4000 Ohms (50~120 kHz exciting frequency)
Range of measurement	0~120 bpm
Precision	±2 bpm
Gain	x1，x2，x4
Range of alarm	0~120 bpm, continuously adjustable between high limit and low limit
Sweep speed	6.25mm/s, 12.5mm/s, 25mm/s
Asphyxia	1~60s, off
Alarm indication	Sound and light indication

EtCO2 (Sidestream)

Measure method	Infrared spectrum
Measure mode	Sidestream
Range of EtCO2 measurement	0.0~13.1% (0~99 mmHg)
Resolution	1 mmHg
Unit	%, mmHg
Precision	At <5 % CO2，±0.3% (±2.0 mmHg) At ≥5 % CO2, < 10 % of reading
Range of respiration rate measurement	3~150 bpm
Calibration	Offset calibration: auto, manual Gain calibration
Range of alarm	0.0~13.1 % (0~99 mmHg), continuously adjustable between high limit and low limit
Alarm indication	Sound and light indication

EtCO2 (Mainstream)

Measure method	Infrared spectrum
Measure mode	Mainstream
Range of EtCO2 measurement	0.0~10% (0~76 mmHg)
Resolution	1 mmHg
Unit	%, mmHg
Precision	0.5 % (±4.0 mmHg) or < 10 % of reading, whichever is greater
Range of respiration rate measurement	3~150 bpm
Range of alarm	0.0~13.1 % (0~99 mmHg), continuously adjustable between high limit and low limit
Alarm indication	Sound and light indication

Recorder

Speed of paper feeding	12.5mm/s, 25mm/s, 50 mm/s (Only valid whit B Type recorder)
Recording medium	50mm thermal paper
Recording track	Single track or tri-track

Alarm

Level	Low, medium and high
Indication	Sound and light indication
Setup	Default and custom
Silence	All alarms can be silenced
Sound pressure	45~85 dB (At 1m distance)

Chapter 2 Important Safety Notes

2.1 Intended Use

Multi-Parameters Patient Monitor is used to monitor patient's physiological parameters such as ECG、RESP、SPO2、NIBP、IBP and TEMP continuously，in dynamic and long time。Its intended to be used in various hospital rooms such as Coronary Care Unit，Intensive Care Unit，Neonatal Intensive Care Unit and Operating Room to provide additional information to medical and nursing staff about the physiological condition of the patient.

Warning: Only trained doctors and nurses can use the device.

Warning: Multi-parameter Monitor is not a therapeutic instrument nor is it a device that can be used at home.

2.2 General Safety

1. Safety precautions for safe installation

▭ The input socket of Multi-parameter Monitor can be connected to the electrical wires and common electrical wire can be used.

▭ Only the power supply type of AC 100V~240V 50/60Hz specified by Multi-parameter Monitor can be used.

▭ Connect the electrical wire to a properly grounded socket. Avoid putting the socket used for it in the same loop of such devices as the air conditioners, which regularly switch between ON and OFF.

▭ Avoid putting the monitor in the locations where it easily shakes or wobbles.

▭ Enough room shall be left around the monitor so as to guarantee normal ventilation.

▭ Make sure the ambient temperature and humidity are stable and avoid the occurrence of condensation in the work process of the monitor.

Warning: Never install the monitor in an environment where flammable

anesthetic gas is present.

2. Multi-Parameter Monitor conforms to the safety requirements of IEC 60601-1-1998. This monitor is protected against defibrillation effects.

3. Notes on signs related to safety

CF type defibrillation prevention sign (refer to IEC 60601-1-1998)

The unit displaying this symbol contains an F-Type isolated (floating) applied part providing a high degree of protection against shock, and is defibrillator-proof.

The type CF applied parts provide a higher degree of protection against electric shock than that provided by type BF applied parts.

Attention! Please refer to the documents accompanying this monitor (this manual)!

BF type equipment flag (IEC 60601-1-1988)

The unit displaying this symbol contains an F-Type isolated (floating) applied part providing a high degree of protection against shock, and is defibrillator-proof.

4. When a defibrillator is applied on a patient, the monitor may have transient disorders in the display of waveforms. If the electrodes are used and placed properly, the display of the monitor will be restored within 10 seconds. During defibrillation, please note to remove the electrode of chest lead and move the electrode of limb lead to the side of the limb. The electrode of the defibrillator should not come into direct contact with the monitoring electrodes. Please ensure the monitor is reliably grounded and the electrodes used repeatedly should be kept clean.

Warning: When conducting defibrillation, do not come into contact with the patient, the bed and the monitor. Otherwise serious injury or death could result.

5. To guarantee the safe operation of the monitor, Multi-Parameter Monitor is provided with various replaceable parts, accessories and consuming materials (such as sensors and their cables, electrode pads). Please use the products provided or designated by the manufacturer.

6. Multi-parameter Monitor only guarantees its safety and accuracy under the condition that it is connected to the devices provided. If the monitor is connected to other undesignated electrical equipment or devices, safety hazards may occur due to such causes as the cumulating of the leakage current.

7. To guarantee the normal and safe operation of the monitor, a preventive check and maintenance should be conducted for the monitor and its parts every 6-12 months (including performance check and safety check) to verify the instrument can work normally and is in a proper working condition and it is safe to the medical personnel and the patient and has met the accuracy required by clinical use.

Attention: The monitor does not contain any parts for self-repair by users. The repair of the instrument must be conducted by the technical personnel authorized by company.

2.3 Some important notes for safety

PATIENT NUMBER

The monitor can only be applied to one patient at a time.

INTERFERENCE

Do not use cellular phone in the vicinity of this equipment. High level of electromagnetic radiation emitted from such devices may result in strong interference with the monitor performance.

ACCIDENTAL SPILLS

To avoid electric shock or device malfunction liquids must not be allowed to enter the device. If liquids have entered a device, take it out of service and have it checked by a service technician before it is used again.

ACCURACY

If the accuracy of any value displayed on the monitor or printed on a printout paper is questionable, determine the patient’s vital signs by alternative means. Verify that all equipment is working correctly.

ALARMS

Do not rely exclusively on the audible alarm system for patient monitoring. Adjustment of alarm volume to a low level or off during patient monitoring may result in a hazard to the patient. Remember that the most reliable method of patient monitoring combines close personal surveillance with correct operation of monitoring equipment.

The functions of the alarm system for monitoring the patient must be verified at regular intervals.

BEFORE USE

Before putting the system into operation visually inspect all connecting cables for signs of damage. Damaged cables and connectors must be replaced immediately.

Before using the system, the operator must verify that it is in correct working order and operating condition.

Periodically, and whenever the integrity of the product is in doubt, test all functions.

CABLES

Route all cables away from patient's throat to avoid possible strangulation.

DISCHAGE TO CLEAR PATIENT DATA

When admitting a new patient, you must clear all previous patient data from the system. To accomplish this, shut down the device, then turn on it.

DISPOSAL OF PACKAGE

Dispose of the packaging material, observing the applicable waste control regulations and keeping it out of children's reach.

EXPLOSION HAZARD

Do not use this equipment in the presence of flammable anesthetics, vapors or liquids.

LEAKAGE CURRENT TEST

When interfacing with other equipment, a test for leakage current must be performed by qualified biomedical engineering personnel before using with patients.

BATTERY POWER

The device is equipped with a battery pack. The battery discharge even when the device is not in use. Store the device with a fully charged battery and check the battery status of the devices in storage once a month.

DISPOSAL OF ACCESSORIES AND DEVICE

Disposable devices are intended for single use only. They should not be reused as performance could degrade or contamination could occur.

The service life of is five years. At the end of its service life, the product described in this manual, as well as its accessories, must be disposed of in compliance with the

guidelines regulating the disposal of such products. If you have questions concerning disposal of products, please contact company or its representatives.

EMC

Magnetic and electrical fields are capable of interfering with the proper performance of the device. For this reason, make sure that all external devices operated in the vicinity of the monitor comply with the relevant EMC requirements. X-ray equipment or MRI devices are a possible source of interference as they may emit higher levels of electromagnetic radiation. Also, keep cellular phones or other telecommunication equipment away from the monitor.

INSTRUCTION FOR USE

For continued safe use of this equipment, it is necessary that listed instructions were followed. However, instructions listed in this manual in no way supersede established medical practices concerning patient care.

LOSS OF DATA

Should the monitor at any time temporarily lose patient data, the potential exists that active monitoring not being done. Close patient observation or alternate monitoring devices should be used until monitor function is restored.

If the monitor does not automatically resume operation within 60 seconds, power cycle the monitor using the power on/off switch. Once monitoring is restored, you should verify correct monitoring state and alarm function.

2.4 Classifications

The Monitor is classified, according to IEC601-1:1988 as:

Type of protection against electric shock:	I
Degree of protection against electric shock:	CF: ECG, Temp, Resp, IBP CF: NIBP, SpO2
Degree of protection against harmful ingress of water:	Ordinary Equipment (enclosed equipment without protection against ingress of water)
Degree of safety of application in the presence of a flammable anesthetic-mixture with air or with oxygen or nitrous oxide:	Not suitable
Mode of operation:	Continuous operation

I: Class I equipment
CF: Type CF applied part
BF: Type BF applied part
Not suitable: Equipment not suitable for use in the presence of flammable anesthetic mixture with air or with oxygen or nitrous oxide.

2.5 Safe Operating and Handling Conditions

Method(s) of sterilization or disinfection recommended by the manufacturer:	Sterilization: not applicable Disinfection: See "The Maintenance and Cleaning of the System->General Cleaning"
Electromagnetic interference	No cellular telephone nearby
Electrosurgical interference damage	No damage
Diathermy instruments influence	Displayed values and prints may be disturbed or erroneous during diathermy.
Defibrillation shocks	The monitor specifications fulfill the requirements of EC13, IEC 601-2-27, -30, -34 and EN865.
Auxiliary outputs	The system must fulfil the requirements of standard IEC 601-1-1.

Chapter 3 Preparations before the Use of the Monitor

3.1 Unpacking the Case

▭ Unpack the packaging case

There are two layers inside the box and the upper paper box contains such documents as the electrical wire, various patient sensors and user's manual (this manual), warranty card, certificate and particular paper and the lower foam case contains the monitor.

▭ Remove the monitor and accessories

Attention: please place the monitor on level and stable supporting plane, not on the places that can easily shock or wake. Enough room should be left around the monitor so as to guarantee normal ventilation.

▭ Keep all the packaging materials for future use in transportation or storage.

▭ Check the monitor and accessories

Check the monitor and its accessories one by one in accordance with the particular paper. Check to see if the parts have any mechanical damages. In case of problems, contact our company or the agent of our company.

3.2 Connecting to Power

3.2.1 AC Power

▭ Confirm the rated AC current is: AC 100V~240V 50/60Hz

▭ Remove the electrical wires provided along with the instrument, and put its output end plug (round headed) into the AC current socket on the back of the monitor, and the plug of input end into a grounded socket of the mains (It must be a special socket of the hospital), connect the monitor through the earth one of electrical wires.

▭ When the indicating light above the power switch on the panel of the monitor is green, it means the AC power is on. And when the monitor is not connected to AC power and the built-in DC battery is used as the power source, the indicating light is orange.

Warning: The AC cord provided along with the instrument must be used for connection with AC power and no other electrical wires shall be used.

Warning: The monitor must be connected to a properly installed power outlet with protective earth contacts only. If the installation does not provide for a protective earth conductor, disconnect the monitor from the power line and operate it on battery power.

The equipment has no mains switch. The equipment is switched completely only by disconnecting the power supply from the wall socket. The wall socket have to be easily accessible.

Note: For measurements in or near the heart we recommend connecting the monitor to the potential equalization system. Use the green and yellow potential equalization cable and connect it to the pin labeled with the ⏚ symbol.

3.2.2 Battery Power

The monitor has a battery pack to provide power to the monitor whenever AC power is interrupted. The battery is generally referred to as the “battery”.

You must charge the battery before using it. There is no external charger. The battery is charged when the monitor is connected to AC power. A fully depleted battery will take about 15 hours to fully charge. To assure a fully charged battery which is ready for use, we recommend that the monitor be plugged into AC power whenever it is not in use.

Depending on usage, you can get 60 to 90 minutes of battery power on a new, fully-charged battery on a monitor. NIBP and SpO2 monitoring and the usage of the recorder will drain battery power faster than other parameters.

Note: When the monitor is connected to AC current, the battery is in a state of being recharged. When it is unable to be connected to the AC current, the battery can be used to supply power, and at this time it is unnecessary to use the electrical wires, and the instrument can be switched on directly.

Note: A "Cell battery too low" message at the bottom of the screen and an audible system alarm indicate 5 minutes of battery life remaining. You should connect the monitor to an AC power source when the message is displayed.

Attention: The battery discharges even when the device is not operating.

- **Please ensure that the battery is always fully charged when you are keeping the device in storage for an extended period of time.**
- **Check the battery status at least once every month and recharge the battery.**

Note: This monitor contains a rechargeable battery. The average life span of this type of battery is approximately three years. When replacement becomes necessary, contact a qualified service representative to perform the replacement.

Disposal Notice

Should this product become damaged beyond repair, or for some reason its useful life is considered to be at an end, please observe all local, state, and federal regulations that relate to the disposal of products that contain lead, batteries, plastics, etc.

■ Install Battety

The battery storage is located at the bottom of the monitor, following the steps to install a battery.

1、Open the battery gate according to the direction marked on the monitor.

2、Push the baffle to the opposite side of the battery.

3、Push the battery into a with the electrode point to the bottom of the monitor.

4、After push the battery inside the storage withdraw the baffle to the middle position.

5、Close the gate.

■ Uninstall battery

1、Open the battery gate according to the direction marked on the monitor.

2、Push the baffle to the opposite side of the battery.

3、Take out the battery, and then close the gate.

3.3 Connecting to the Central Monitor System

If the user intends to connect the monitor to the central monitoring system, plug its connecting electrical cable into the Network Connector interface at the back of the monitor.

Note: This monitor can only be connected to the central monitoring system provided and do not attempt to connect this monitor to other central monitoring system.

3.4 Start up

- Press the power switch on the front panel of the monitor (refer to Fig. 1-4)

- About 50 seconds after the monitor is switched on, after passing the self-examination of the system, the monitor enters the monitoring screen.

Warning: In case the monitor is found to be working abnormally or indication of errors appears, please do not use this monitor for monitoring and should contact the after-sale service center as soon as possible.

3.5 Connecting to Various Kinds of Sensors

Connect various kinds of sensors needed to the relevant sockets on the monitor and the monitored locations on the body of the patient. Refer to the relevant content of **Chapter 5** for details.

3.6 Preparation of Recorder

If the monitor you use has been provided with a recorder, before starting of monitoring please check if the recorder has had recording thermal paper installed. The thermal side (that is the smoother side) should face upwards and a small section should be pulled out onto the outlet of the paper (on the left panel of the monitor, refer to Fig. 1-1)

Chapter 4 Operation Instructions for the Monitor

Note: For Concision, the following terms are used to describe one or more operations

Choice–press the Trim Knob and move the cursor onto the item that needs to be changed.

Conform-- press the Trim Knob.

Select-- move the cursor onto the item and press the Trim Knob.

4.1 System Menu

Hide and display system menu.

The profile of system menu is shown in Fig. 4-1-1. To hide, press the **Exit** key; to display the system menu under hide mode, press the **Trim Knob.**

Fig. 4-1-1: System Menu

4.2 Main Menu

There is a system information region in each dialogue window for prompting current operation.

Press **MAIN** button, and a following setup dialogue window (Fig. 4-2.1) will be displayed.

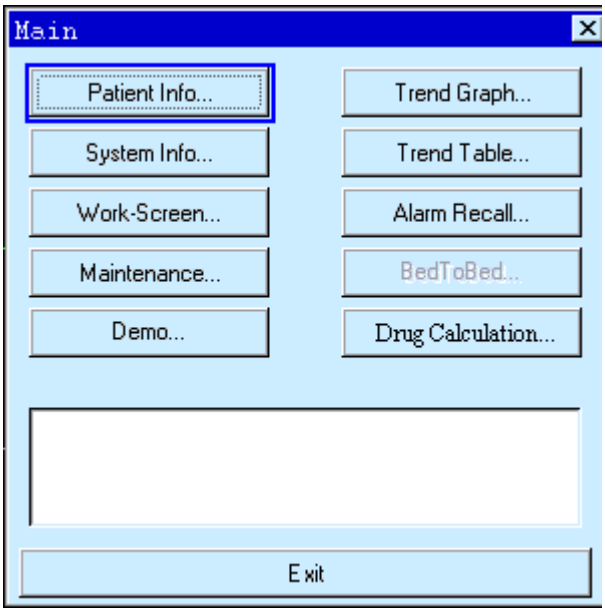


Fig. 4-2-1.1: Main menu

4.2.1 Setup patient information

Press **Patient Info…** button, and a following patient information dialogue window (Fig. 4-2-1.2) will be displayed.

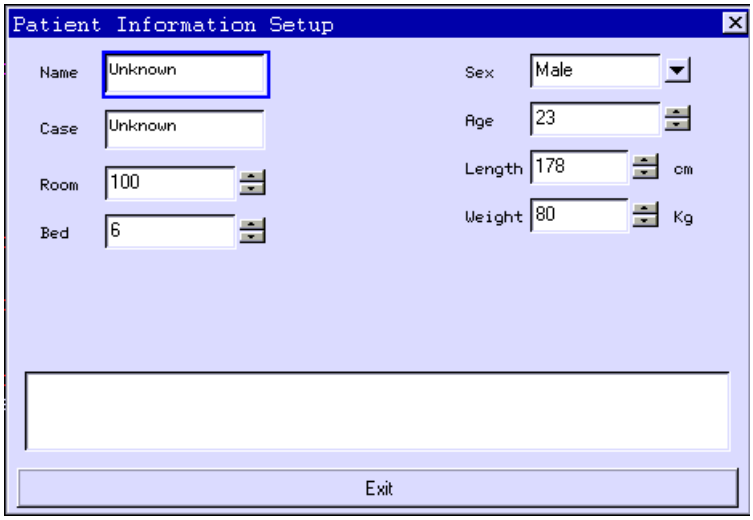


Fig. 4-2-1.2: Setup patient information

Name	The name of patient (choose from A-Z and 0-9). The length of name can be 15 characters at most. Enter OK and enter.
Case	The number of patient (setup due to the actual condition of the hospital). Enter OK and enter.
Room	The number of patient room.
Bed	The number of patient bed.
Height	The height of patient (turn the dial, once to increase/decrease 1 cm).
Sex	The sex of patient (male, female).
Age	The age of patient.
Weight	The weight of patient (turn the dial, once to increase/decrease 1 kg).

4.2.2 Setup system information

Press **System info…** button, and a following setup system information dialogue window (Fig. 4-2-2) will be displayed.

Language: User can setup displaying language of the system.

Sweep Speed: User can choose from three levels: 12.5mm/s, 25mm/s, 50mm/s. Setting 50mm/s in type A recorder, which only support print speed of 25mm/s, will result in the recorder printing failure.

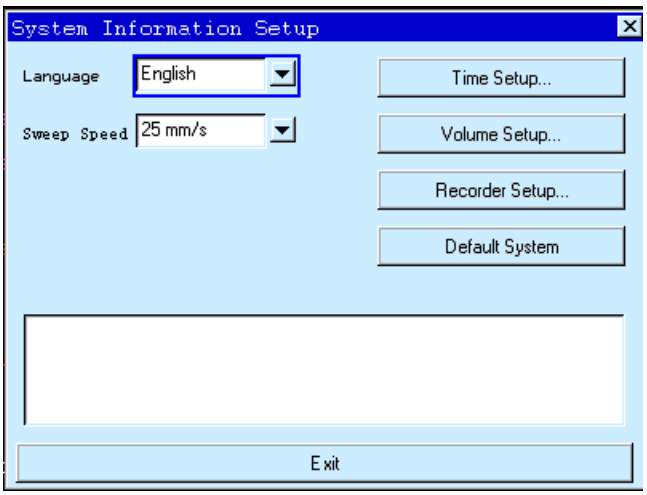
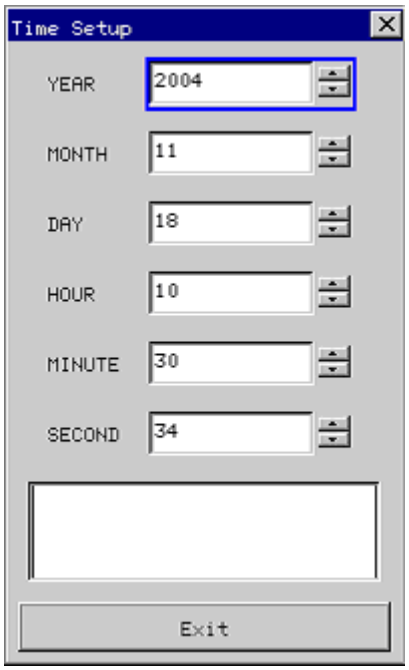


Fig.4-2-2: Setup system information

4.2.3 Setup system time

Press **Time Setup…** button，and a following setup system time information window (figure 4-2-3) will be displayed.



Fig, 4-2-3: Setup system time

User can setup system time information. Setting time before monitoring is suggested. If time is setup during monitoring, we suggest close the current window, switch off and restart. The changed time will be available after exit the current window.

4.2.4 Setup system sound volume

Press **Volume setup…** button , and a following system sound volume window (Fig. 4-2-4) will be displayed.

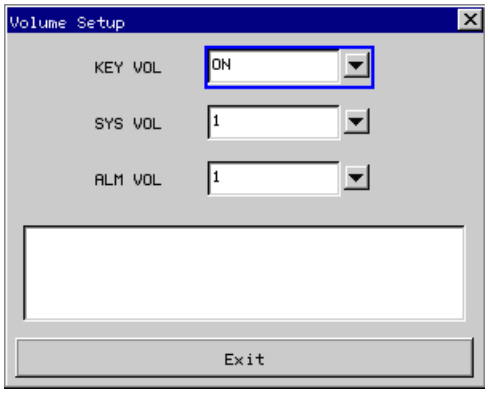


Fig. 4-2-4: Setup system sound volume

KEY VOL	Select keyboard sound ON or OFF.
SYS VOL	Choose the level (1-3) of heart beat sound volume or turn OFF.
ALM VOL	Choose the level (1-3) of alarm sound volume or turn OFF.

4.2.5 Setup recorder

Press **Recorder Setup…** button ,and a following setup recorder window (figure 4-2-5) will be displayed.

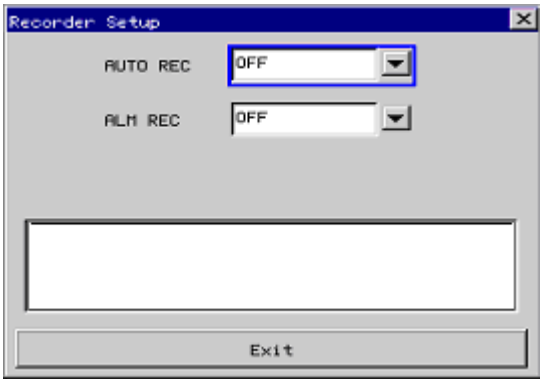


Fig.4-2-5: Setup recorder

AUTO REC	Turn off cycle printing or select from 1, 5, 10, 30, 60 minutes interval to do cycle print.
ALM REC	Turn off alarm printing or turn on to print automatically when alarming.

4.2.6 Restore default system setup

Press **Default System** button, and a following Default System Setup window (figure 4-2-6) will be displayed, select one item in this window will restore the system setup to default setup. There are three options: ADULT, CHILD, NEONATAL.

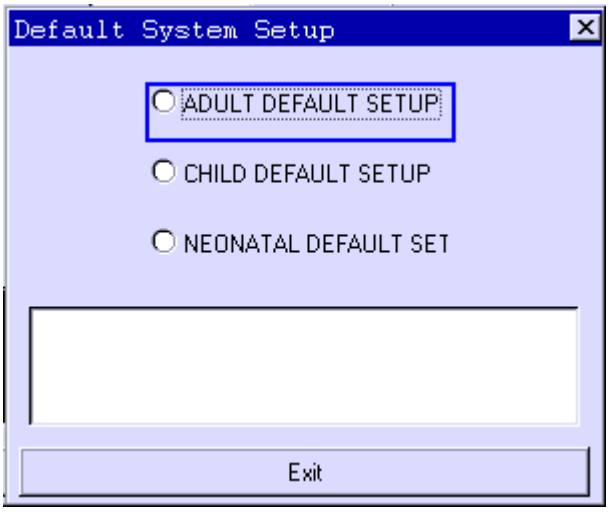


Fig.4-2-6: Restore default system setup

4.2.7 Setup work-screen

Press **Work-Screen…** button，and a following setup display screen window (Fig.4-2-7) will be displayed.

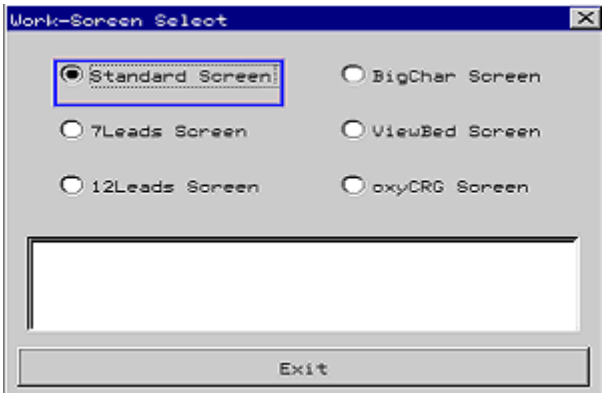


Fig. 4-2-7: Setup work-screen

Standard Screen The Standard screen displays the parameters and the waveforms being monitored. This is the basic operating screen of the monitor.

7-Leads Screen A form in which seven leads of ECG waves is displayed in one screen.

12-Leads Screen	A form in which twelve leads of ECG waveforms is displayed in one screen (only available after twelve leads module is configured).
BigChar Screen	A form in which one lead of ECG waveform and the parameters are displayed in magnified characters.
ViewBed Screen	A form that is able to monitor one lead of ECG waveform and parameters of other bed (This function is not valid).
oxyCRG Screen	One lead of ECG, respiration waveform, blood oxygen waveform, totaling to three lines of waveforms. The lowest port of the screen is the oxyCRG screen consisting of three trends: HR Trend, SpO2 Trend and RR Trend.

4.2.8 Setup maintenance (do not belong to user operation item)

Press **Maintenance…** button, and a following window (Fig. 4-2-8.1) that ask to enter password will be displayed.

Fig.4-2-8.1 Enter password window

Entering the wrong password will exit current window without prompt. Entering the right password (**125689**) will display following equipment maintenance dialogue window (Fig. 4-2-8.2).

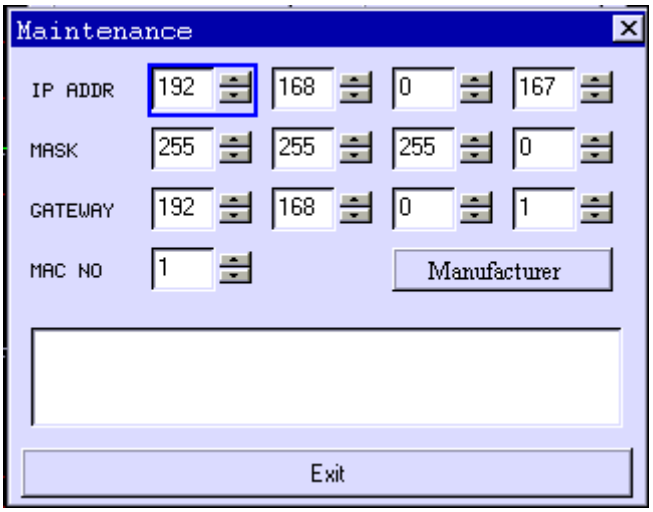


Fig. 4-2-8.2 Setup maintenance

IP ADDR: It is the IP address of this bedside equipment. When programming the IP address of the equipment, Caution that this IP address is a critical data of system in constituting central monitoring network, and therefore should not conflict with other equipments in the network.

MASK: It is the IP address masks of this bedside equipment. Masks and IP address constitution fix this unique equipment in the network.

GATEWAY: It is the gateway of the network. Set this item to insure that all monitors are in the same section of network.

MAC NO: It is the only one equipment number in this system: 1-64. Do not repeat, since it is anther critical data of system in constituting central monitoring network.

4.2.9 Setup Manufacturer maintenance

Not belong to user operation item.

4.2.10 Setup Demo function

Press **Demo…** button, and a following window (Fig. 4-2-10) that ask to enter password will be displayed.

Fig.4-2-10 Enter password window

Entering the wrong password will exit current window without prompt. Entering the right password will enters the Demonstration Waveform status.

The purpose of waveform demonstration is only to demonstrate the machine performance, and for training purpose. In clinical application, this function is not recommended because the DEMO will mislead the hospital workers to treat the waveform and parameter as actual data of the patient, which may result in delay of treatment or mistreatment.

4.2.11 Display of trend map

Press **Trend Graph…** button ， and a following trend graph window (Fig. 4-2-11) will be displayed.

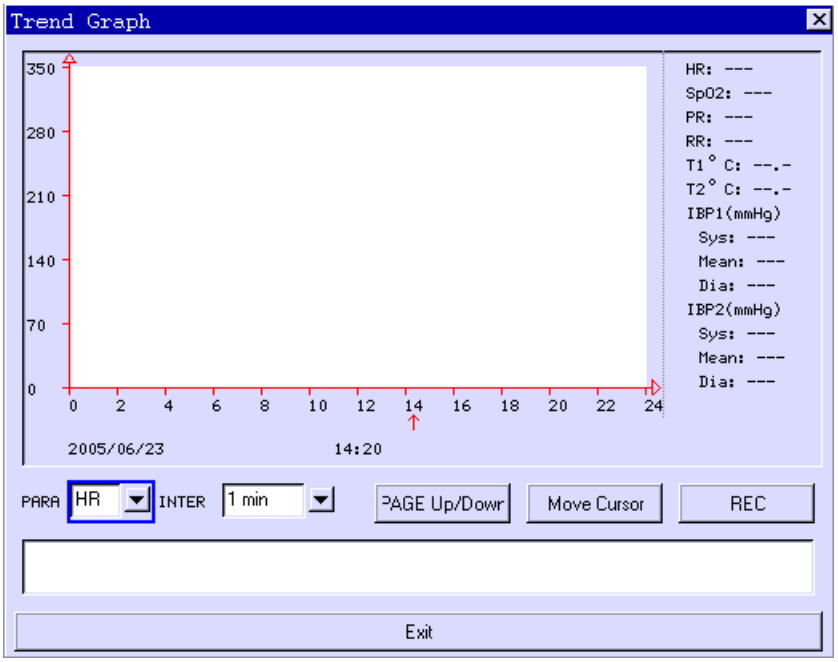


Fig. 4-2-11: Display of trend graph

multiple-parameter monitor can store 96 hours' trend data.

PARA: One of the parameters of HR, SpO2, PR, RR, IBP1, IBP2, T1, T2, EtCO2 can be chosen to see over its trend graph.

INTER: You can choose from 1, 5, 10, 30, 60 minutes, which is the minimum unit when using dial to move cursor after selecting "move cursor".

PAGE Up/Down: One screen of trend map express 24 hours. Press it, and use the dial to turn pages.

Move Cursor: Press it, and use the dial to move cursor.

REC: Print current trend graph through recorder.

Parameters of current location of the cursor can be displayed in the top right corner.

4.2.12 Display of trend data

Press **Trend Table…** button， and a following trend data window (Fig. 4-2-12) will be displayed.

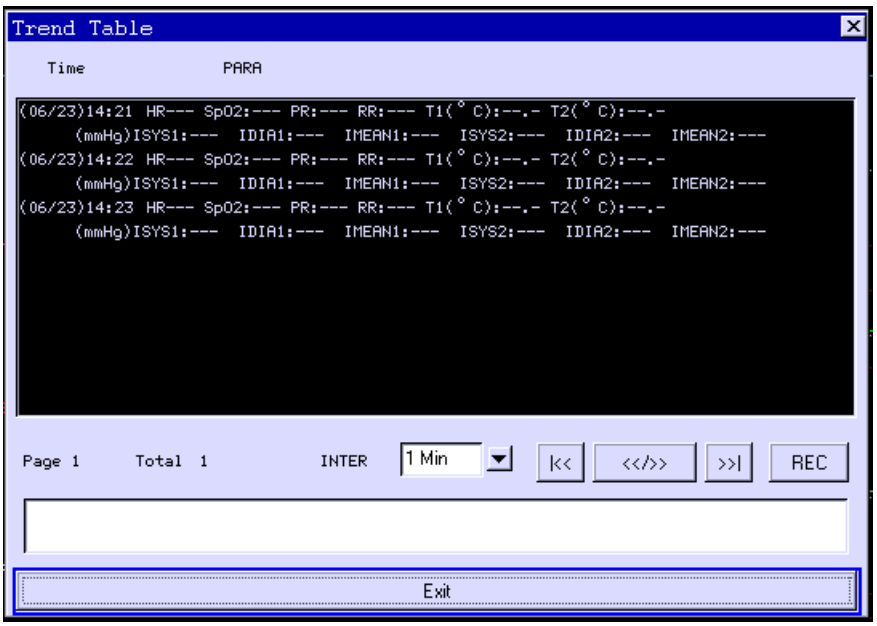


Fig.4-2-12: Display of trend data

INTER: Displayed intervals between trend data. Options: 1, 5, 10, 30, 60 minutes.

|<<: Turn to the first page.

>>|: Turn to the last page.

<</>>: After press this button, you can turn the page forward/backward by turning the dial.

REC: Print the trend data in current screen through recorder.

4.2.13 Display of alarm recall

Press **Alarm Recall…** button，a following alarm recall window (Fig.4-2-13) will be displayed.

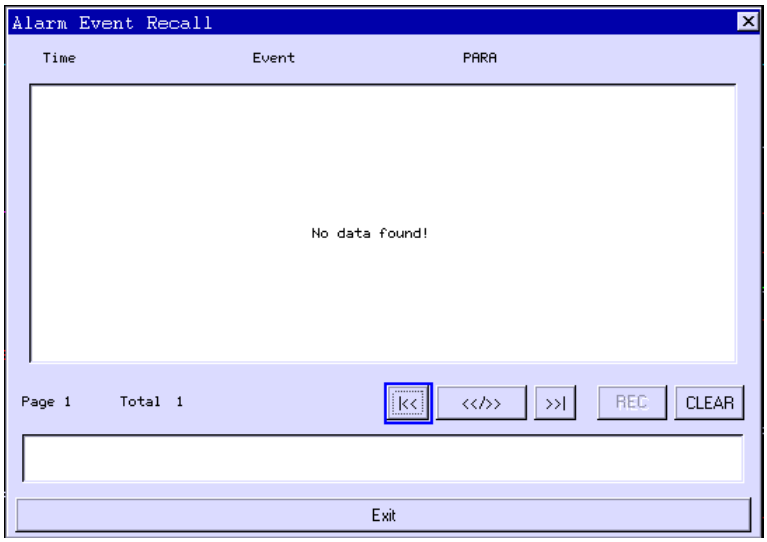


Fig. 4-2-13 Display of alarm recall

|<<: Turn to the first page

>>|: Turn to the last page.

<</>>: After selecting this button, you can turn one page forward/backward by turning the dial.

REC: Print current alarm events through recorder.

Clear: Clean up all of the alarm events records.

4.2.14 Calculate drug concentration

Press **Drug Calculation…** button , and a following drug concentration calculating window (Fig. 4-2-14) will be displayed.

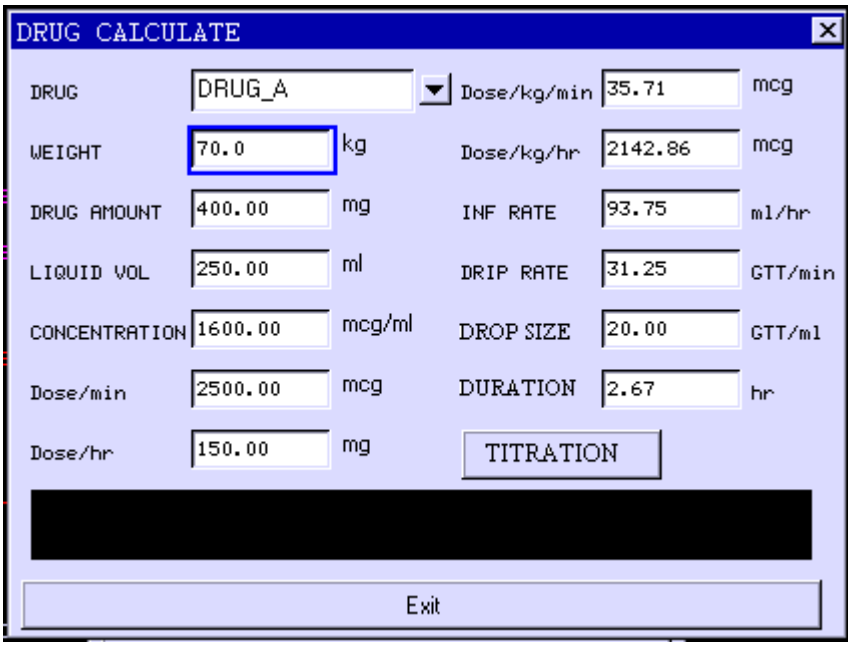


Fig. 4-2-14

This drug concentration calculation is to facilitate doctor's work, to do calculation of some frequently used drugs, and to output the content of titration table in the recorder.

The types of drugs which can be calculated in the system are as follows: AMINOPHYLLINE , DOBUTAMINE , DOPAMINE , EPINEPHRINE , HEPARIN, ISUPREL , LIDOCAINE , NIPRIDE , NITROGLYCERIN , PITOCIN. Drug A, drug B, drug C, drug D, drug E are provided additionally to replace any of the drugs.

Use following formulas to calculate drug dosage：

Concentration = Drug total amount/ Liquid volume

INF Rate = Drug dosage / Drug concentration

Duration = Drug total amount/ drug dosage

Drug dosage = INF Rate x Drug concentration

In drug calculation window, operator should first select the name of the desired drug, and then enter patient's weight, and then enter other known values.

Drug：To select drug, move the cursor to " **Drug**", press the dial, and then turn the dial. Only one type of drug can be chosen each time to do calculation.

Drug A, Drug B, Drug C, Drug D, Drug E are not real drug names, but merely drug symbols. The respective units of these five drugs are unchangeable, and operator can choose appropriate units due to usage traditions. The principle of units denotation is as follows：

The units of Drug A, Drug B， Drug C are fixed as a series of "gram": g, mg, mcg.

The units of Drug D are fixed as a series of "unit": unit、k unit、m unit.

The units of Drug E are fixed as " mEq".

Weight: Operator should enter the weight of patient in the first or the second item. It is an independent data and can be used only in drug calculation function.

Turn the dial and move the cursor respectively to each calculate item of the formula， then press the dial, select the value, and press the dial to confirm it. The value will be displayed in the proper place after selecting. The value of each calculate item should be within its limit; if the calculation result is beyond the limit, ' ---' will be displayed。

The value of other menu items can be input only after the weight of patient and the drug name have been entered. The initial values offered by the system are random numbers, and cannot be used as calculation standard. Operator should reenter a series of values that are appropriate for the patients due to doctor's advice.

The units of each drug, which may be one or a series of units, are unchangeable. Operator should select appropriate units due to doctor's advice. In one series of units, unit system will be adjusted automatically due to current input value. If the value is beyond the limit, " ---" will be displayed automatically.

After one value is entered, a prompt will be displayed automatically to remind the operator to examine the accuracy of the input value. Calculation results can be reliable and safe only when the accuracy of all of the input values is assured.

Instillation speed and drop volume are out of function under newborn condition.

The values in the table can be irrelevant to the patient monitored by this equipment. Therefore the value of patient's weight in this menu can be different from the same item in patient's information. The value of this menu will not be influenced by patient's information.

4.2.15 Titration table

To enter titration table (figure 4-15), press **Titration table** button in drug calculation menu, and a following titration table window (Fig. 4-2-15) will be displayed.

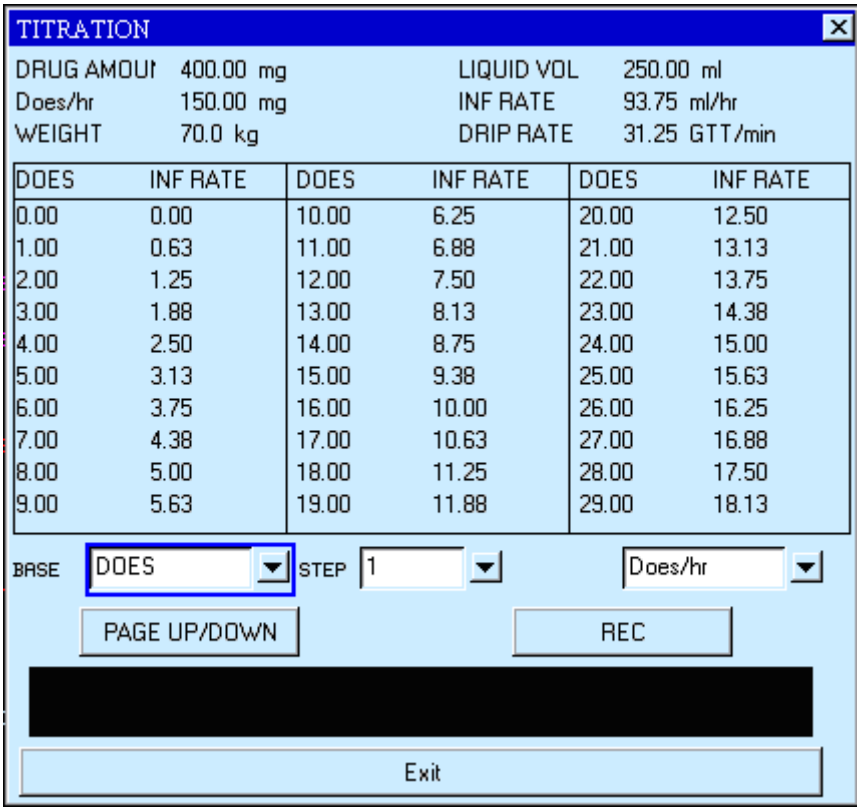


Fig. 4-2-15 Display of titration table

In titration table ,turn the dial and move the cursor to "**BASE**" ,and then press the dial to select the desired item. Three items, "DOSE", "INF RATE" and "DRIP RATE", can be chosen. Press the dial to confirm after selecting.

Move the cursor to "**STEP**", press the dial to select step length. Any value within 1-10 is available.

Move the cursor to dosage unit selection box, press the dial to select dosage unit.

Move the cursor to "**PAGE UP/DOWN**" , press the dial , turn it to see over the

preceding page and following page.

Move the cursor to "**REC**", press the dial, output data of titration table in current displayed environment.

Move the cursor to "**Exit**", press the dial to back to "drug calculation" window.

4.3 Screen Display

The monitor applies high-lightness multicolor LCD screen, which can show all the parameters, waveforms, data, system time, information of the patients and other prompt information. The whole main screen can be divided into four regions, which are:

- Patients Information and alarm prompt information region (**upmost**)
- User operation menu region (**bottommost**)
- Waveform display region (**left**)
- Parameters display region (**right**)

multiple-parameter monitor has two categories: all-parameter configuration and standard-parameter configuration. Both of them have almost the same operating method. The main difference is that the standard-parameter configuration does not have IBP module and 12-lead ECG module. The standard-parameter configuration is a single-temperature module, while the all-parameter one is a double-temperature module.

There are six display patterns (which can be set in <**Work-Screen**> in <**Main**> menu.

4.3.1 Standard screen

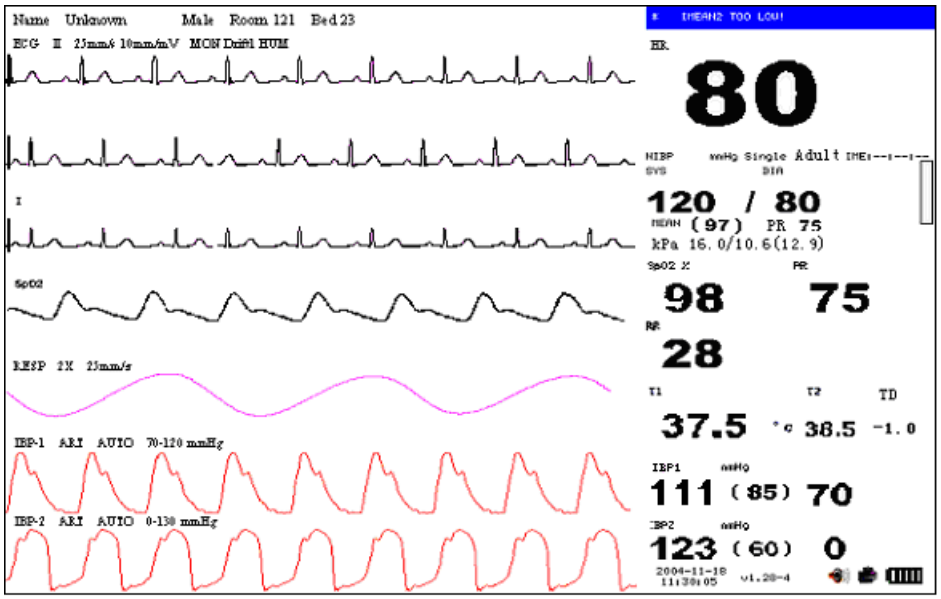


Fig. 4-3-1 Standard screen

At the upmost of the waveform section, there is a one-lead ECG (this lead is called the emphasized monitoring lead, which can be set by select <**LEAD SEL> in <ECG**

Setup>). I-lead ECG, SpO2 and RESP waveforms are followed orderly.

If there is an IBP module, two IBP waveforms will be displayed at the bottommost region.

4.3.2 7-Leads screen

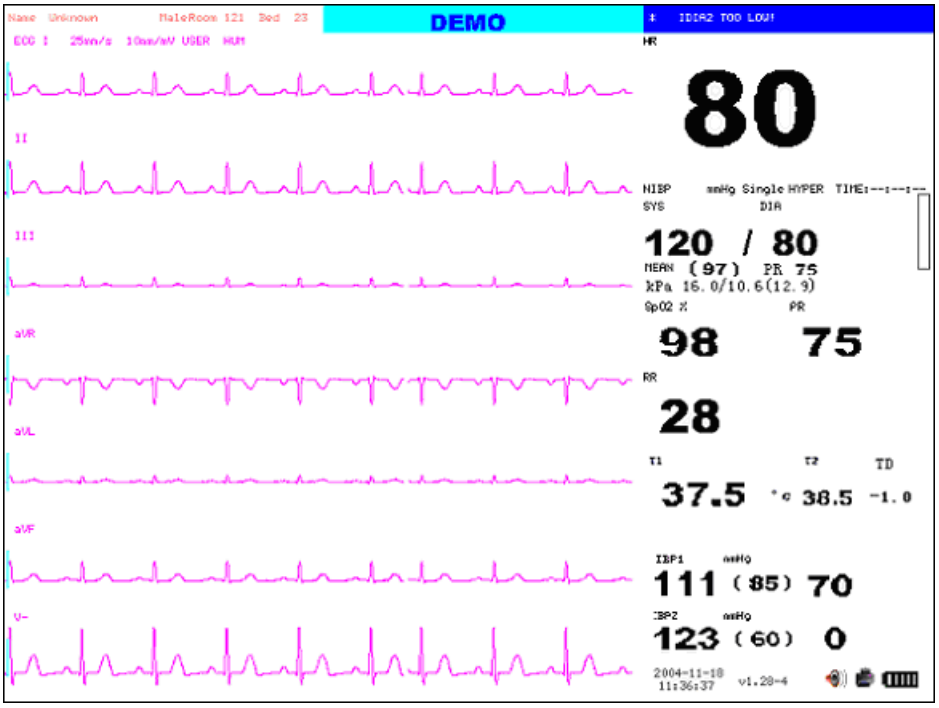


Fig. 4-3-2 7-Leads screen

In waveform section, seven leads electrocardiographs are displayed. They are I-lead, II-lead, III-lead, aVR, aVL, aVF and V in turn.

4.3.3 12-Leads screen

At the upmost region of waveform section, there is an electrocardiogram of one lead (this lead is called the emphasized monitoring lead, which can be set by select <**LEAD SEL**> in <**ECG Setup**>). I-lead, II-lead, III-lead, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6 are followed orderly.

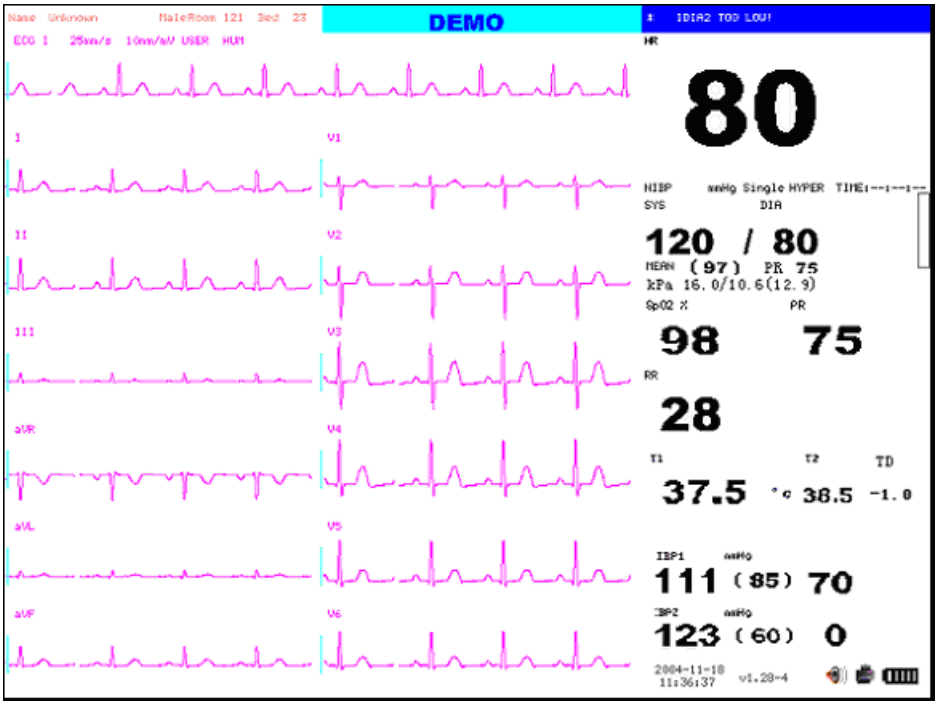


Fig. 4-3-3 12-Leads Screen

For diagnosis and analysis of cardiac diseases, this monitor has designed a specific pattern of displaying electrocardiographs of all the twelve leads (all leads) in the same screen, which can be worked out by select <**Main**> → <**Work-Screen**> → <**12-Leads Screen**>, as shown in figure 4-3-3. The waveform of the emphasized monitoring lead is at the upmost region of the screen, which can be set by select<**LEAD SEL**>in <**ECG Setup**>. The inferior part of the screen can be divided into two sections: the left one and the right one. The left section shows the electrocardiographs of the limb leads, and the right one shows the electrocardiographs of the chest leads.

4.3.4 Big Char screen

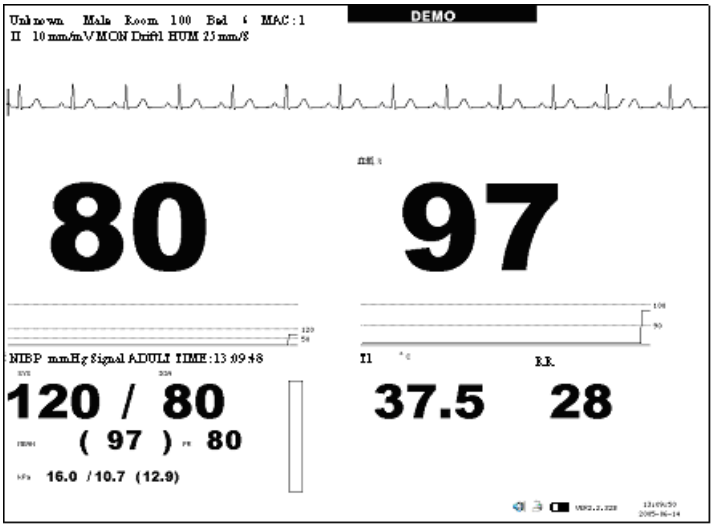


Fig. 4-3-4 BigChar screen

At the upmost region of the waveform section, there is an electrocardiogram of one lead (this lead is called the emphasized monitoring lead, which can be set by select <**LEAD SEL**> in <**ECG Setup**>). The screen mostly displays the main parameters such as heart rate, SpO2, NIBP, temperature and respiration.

4.3.5 oxyCRG screen

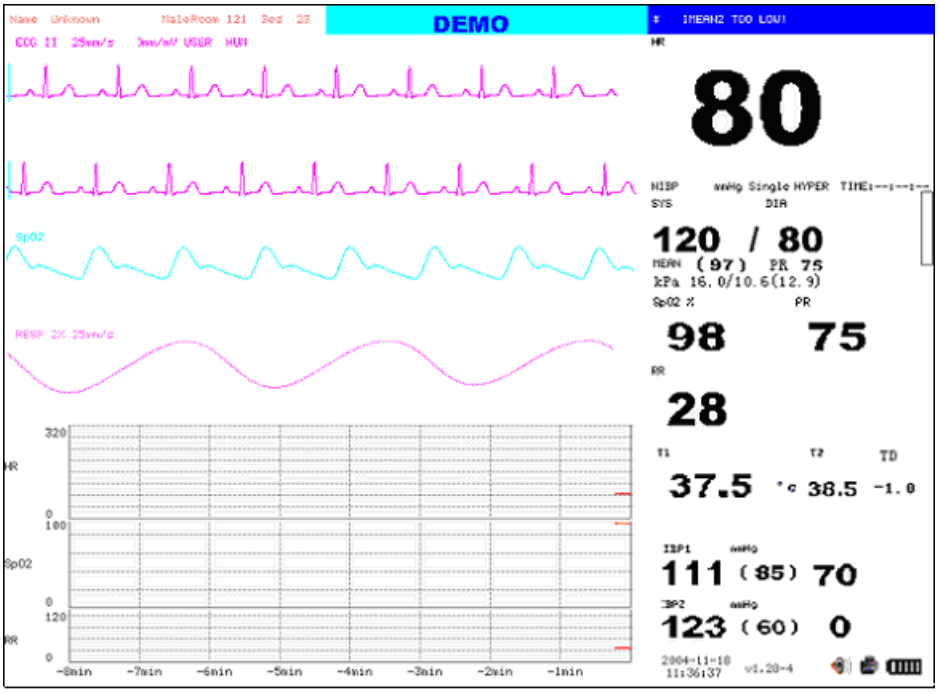


Fig. 4-3-5 oxyCRG screen

At the upmost of the waveform section, there is an eletrocardiagraph of one lead (this lead is called the emphasized monitoring lead, which can be set by select <**LEAD SEL**> of <**ECG Setup**>), the waveforms of RESP and SpO2. The 8 minutes trend graph of heart rate, SpO2 and the respiratory are underlying.

4.3.6 System state display region

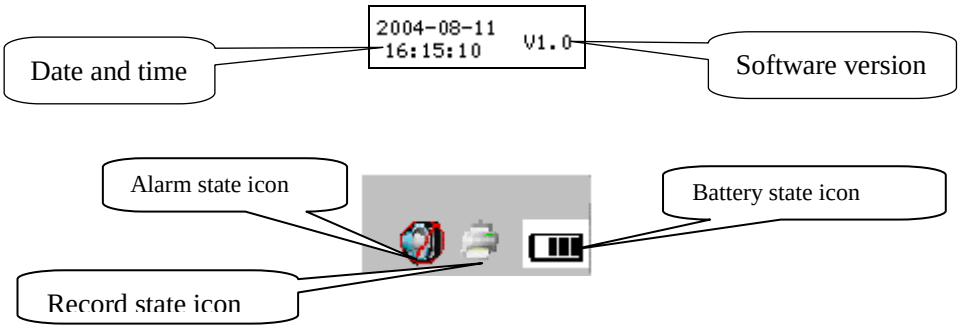


Fig.4-3-6 The region of system state

The alarm sound turns on, that is to say, the monitor will make sound to warn.

The alarm sound turns off, that is to say, when an alarm takes place, the monitor will not make any sound.

The recorder is ready or printing.

The monitor does not have a recorder.

The battery is full.

The battery is half-full.

The battery is empty.

Instruction: When the battery is empty, the system will alarm, in order to remind the users to engage the AC power and charge up. If the monitor has not been charged up in time, the monitor will shut down in 5 to 15 minutes because of short of power.

4.3.7 Parameters display region

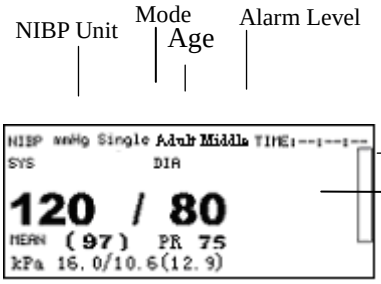
This icon will be displayed glittery during the monitoring, whose frequency is the same as heart rate measured.

The alarm level of HR

The HR update mode

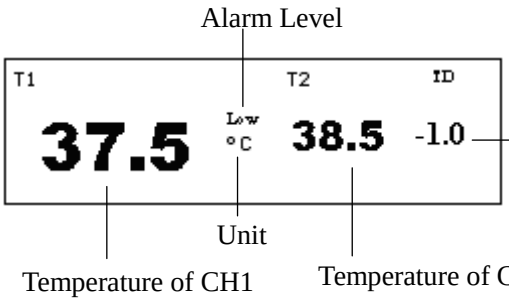
Heart Rate measured，unit: bpm.

When the ECG sensor off, the symbol "---" will be displayed here.

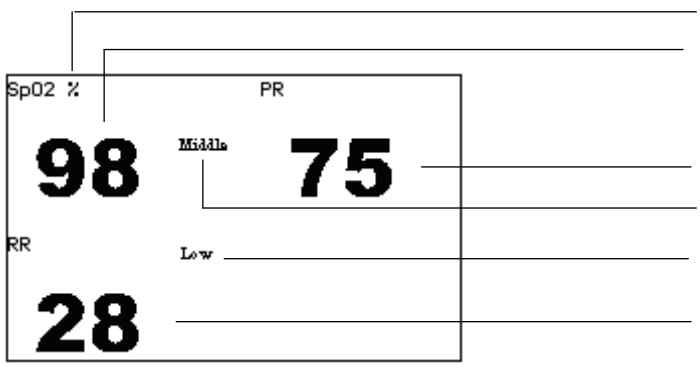


Bar-Graph of cuff pressure

Report the error information when measurement error



Difference of CH1 and CH2



SpO2 Unit

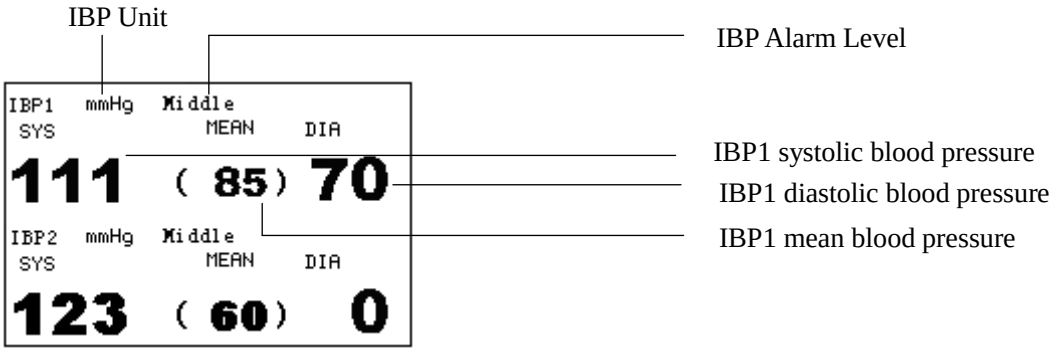
SpO2

Pulse Rate

SpO2 alarm level

Respiration Rate alarm level

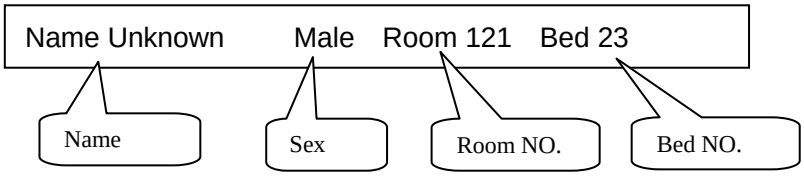
Respiration Rate



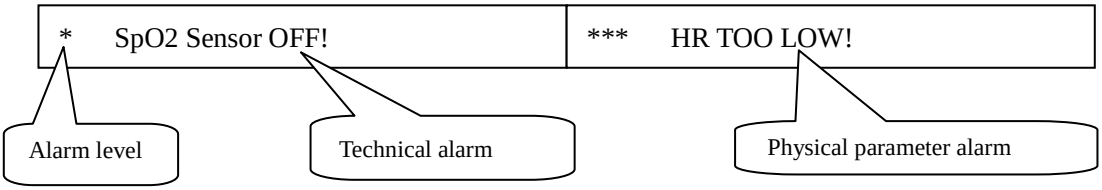
4.3.8 Information region

Information region is at the top of the screen.

Patient information region:



Alarm information region:



Alarm level:

* Low-level alarm
** Middle-level alarm
*** High-level alarm

Parameter alarm , the region of this parameter will display flickeringly in order to warn.

Chapter 5 Parameters Measurement

5.1 Measurement of ECG/HR

5.1.1 Principles of Measuring

Before the mechanical contraction, the heart will first produce electrization and biological current, which will be conducted to body surface through tissue and humors; the current will present difference in potential in different locations of the body, forming potential difference ECG, also known as body surface ECG or regular ECG, is obtained by recording this changing potential difference to form a dynamic curve. Multi-Parameter Monitor measures the changes in the body surface potentials caused by the heart of the patient, observes the cardioelectric activities, records the cardioelectric waveforms and calculates the HR through the multiple electrodes connected to various cables. The measurement range of HR is 10~300 bpm.

5.1.2 Precautions during ECG Monitoring

Warning: Before connecting the ECG cables to the monitor, please check if the lead wires and cables have been worn out or cracked. If so, they should be replaced.

Warning: It is imperative to only use the ECG cables provided with the instrument by company.

Warning: To avoid burning, when the electrotome operation is performed, the electrodes should be placed near the middle between ESU grounding pad and electrotome and the electrotome should be applied as far as possible from all other electrodes, a distance of at least 15 cm/6 in. is recommended.

Warning: When the electrotome operation is performed, the ECG leadwires should be combined as much as possible. The main unit of the instrument should be placed at a distance from the operation table. Electrical wires and the ECG lead cables should be partitioned and should not be in parallel.

Note: When several parts of equipment are interconnected, the total leakage current is limited to the safety range according to standards IEC 601-2-27.

Warning: Multi-Parameter Monitor is protected against defibrillation effect. When applying defibrillator to the patient, the monitor will experience transient disorderly waveforms. If the electrodes are used and placed correctly, the display of the monitor will be restored within 10 seconds. During defibrillation, the chest leads such as V_1~V_6 should be removed and such limb electrodes as RA, LA, RL, LL should be moved to the side of the limbs.

Warning: All the electrodes and conducting part shall not be into contact with any other conductors including the ground. For the sake of patient safety, all the leads on the ECG cables must be attached to the patient.

Warning: When conducting defibrillation, it is imperative to only use the electrodes recommended by manufacturer.

Warning: Do not come into contact with the patient, bed and the monitor during defibrillation.

Warning: Multi-Parameter Monitor cannot be directly applied to heart and cannot be used for the measurement of endocardio ECG.

5.1.3 Preparatory Steps before the Measurement of ECG/HR

1) Plug the ECG cable into the ECG socket on the right panel of the monitor.

2) Place the electrodes onto the body of the patient and connect them to the relevant lead wires of the ECG cables, and at this moment ECG waveforms will appear on the screen.

3) Set the parameters relevant to ECG monitoring.

5.1.4 Connecting the ECG Cables to the Monitor

Multi-parameter Monitor is provided with three different ECG cables relevant to 3-Lead ECG module, 5-Lead ECG module and 12-Lead ECG module:

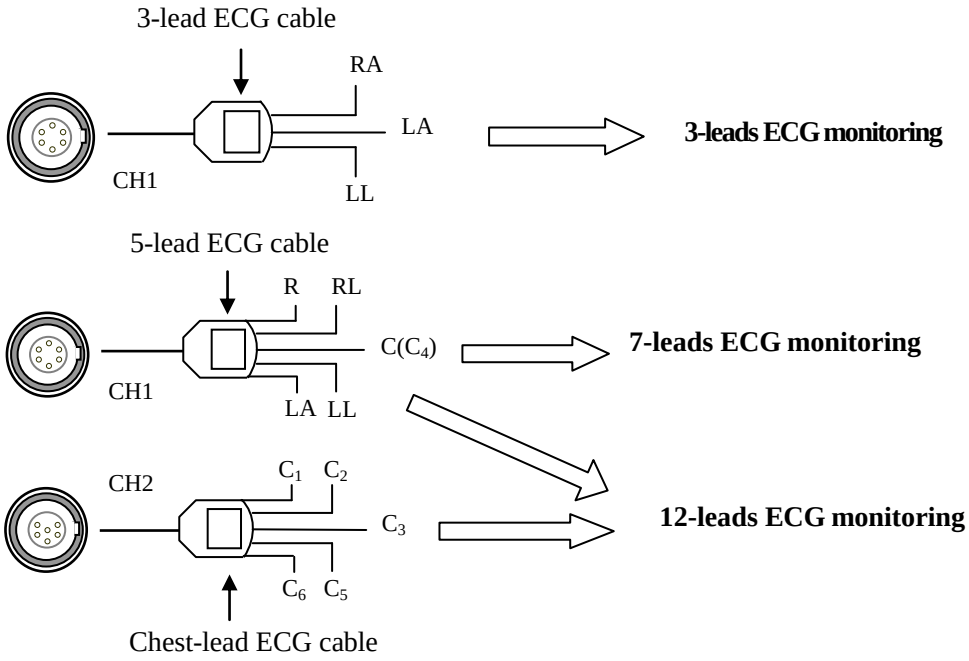


Fig. 5-1-3 Connect the ECG cable to the monitor

1) **3-lead ECG cable**

- Including three limb leads: RA, LL, and LA.
- Relevant ECG socket ECG1 (**It can only be connected to this socket and can not be connected to ECG2**).
- Realize 3-lead ECG monitoring.

2) **5-lead ECG cable**

- Including four limb leads: RA, RL, LL, LA and one chest-lead C (C_4).
- Relevant ECG socket ECG1 (**It can only be connected to this socket and can not be connected to ECG2**).
- Realize 7-lead ECG monitoring.

3) **Chest-lead ECG cable**

- Including five chest leads: C_1, C_2, C_3, C_5, C_6.
- Relevant ECG socket CEG2 (**It can only be connected to this socket and can not be connected to ECG1**).
- Its joint use with 5-lead ECG cable can realize all-lead (12-lead) ECG monitoring.

5.1.5 Connecting the ECG Electrodes to the Patient

1) Connection steps

- Clean the patient's skin and remove the oil stains, sweat stains on the skin with alcohol. If necessary, remove the body hair at the locations where the electrodes are to be placed or grind off the stratum corneum and clean it with alcohol.
- Check if the buttons on the electrodes are clean and free of damage.
- Place the electrodes on the body of patient. Before attaching, smears some conducting cream on the electrodes if the electrodes are not electrolyte self-supplied.
- Connect the cable leads to the electrodes through the buttons of the electrodes.

Note: For patients who tremble a lot or patients with especially weak ECG signals, it might be difficult to extract the ECG signals, and it is even more difficult to conduct HR calculation. For severely burnt patients, it may be impossible to stick the electrodes on and it may be necessary to use the special pin-shape electrodes. In case of bad signals, care should be taken to place the electrodes on the soft portions of the muscle.

Note: Check the irritation caused by each electrode to the skin, and in case of any inflammations or allergies, the electrodes should be replaced and the user should relocate the electrodes every 24 hours or at a shorter interval.

---

2) Location for electrode placement

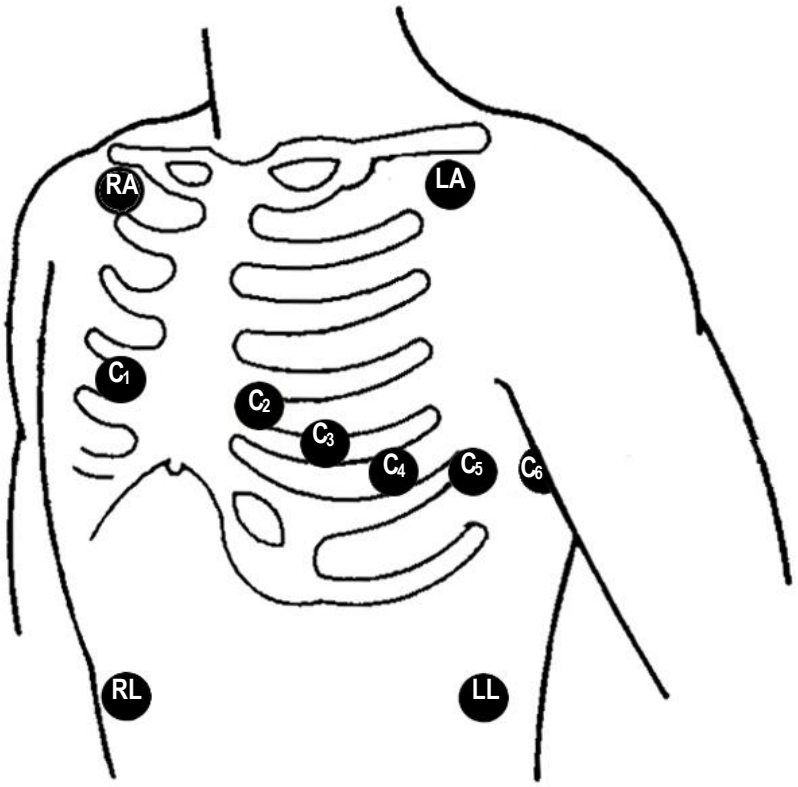


Fig. 5-1-5 Indicative map of the placement of ECG electrodes

The following table shows the lead name to identify each lead wire. Included also is its associated color per AHA and IEC standards.

AHA Label	**AHA Color**	**IEC Label**	**IEC Color**	**Location**
RA	White	R	Red	Under the clavicle of the right shoulder.
LA	Black	L	Yellow	Under the clavicle of the left shoulder.
RL	Green	N	Black	Right lower abdomen.
LL	Red	F	Green	Left lower abdomen.
V_1	Brown	C1	White	4th intercostal space on the right sternum side.
V_2	Yellow	C2	Yellow	4th intercostal space on the left sternum side.
V_3	Green	C3	Green	Center of the line connecting V_2 and V_4.

V_4	Blue	C4	Brown	Node of the left 5th intercostal space and the mid-clavicular line.
V_5	Orange	C5	Black	Node with the left anterior axillary line at the same height with V_4.
V_6	Purple	C6	Purple	Node with the left mid-axillary line at the same height with V_4.

When conducting 3-leads ECG monitoring, use 5-lead ECG cable. The three limb-leads of RA, LA and LL as shown in Fig. 5-1-5, will be placed on the relevant locations. This connection can establish the lead of I, II, III.

When conducting 7-leads ECG monitoring, use 5-lead ECG cable. The four limb-leads of RA, LA, RL and LL as shown in Fig. 5-1-5, will be placed on the relevant locations. This connection can establish the lead of I, II, III, aVR, aVL, aVF; according to actual needs, chest lead C can be placed on any of the locations between C_1~C_6, respectively making one lead of V_1~V_6 established.

When conducting 12-leads ECG monitoring, use the 5-lead ECG cable and chest-lead ECG cable at the same time, and all the leads are placed on the relevant locations respectively as indicated by Fig. 5-1-5, among which the chest lead C of the 5-lead ECG cable is placed on the location of C_4. This kind of connection realizes the establishment of such 12 leads as I, II, III, aVR, aVL, aVF, V_1~V_6.

5.1.6 Setup of ECG/HR parameters

Select the <**ECG**> option in the <**System Menu**>, and then a table will be displayed as in the figure below (Fig 5-1-6.1), where you could set the parameters of ECG/heart rate.

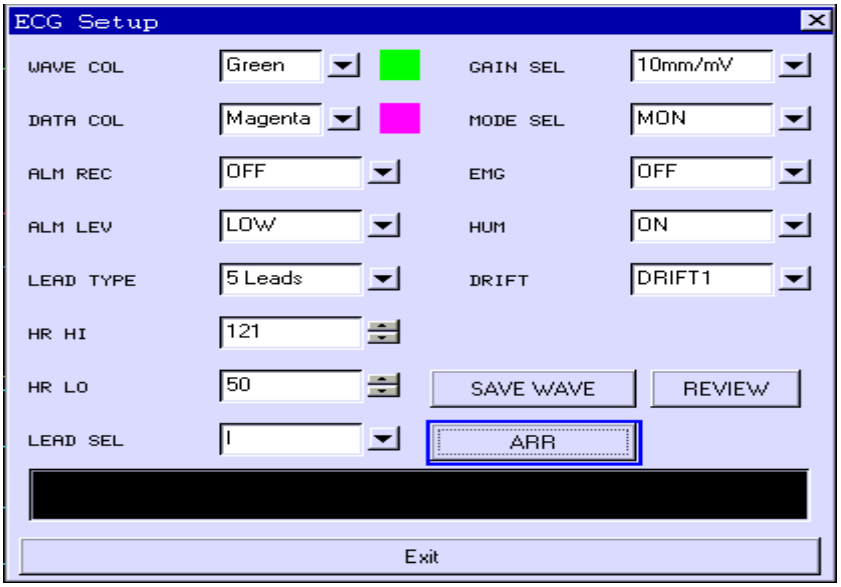


Fig.5-1-6.1 Setup of ECG/HR parameters

WAVE COL	Select the color of the ECG waveform on the screen.
DATA COL	Select the color of HR on the screen.
ALM REC	Select <**ON**> print the alarm of ECG/HR. Select <**OFF**> do not print the alarm of ECG/HR.
ALM LEV	Set the degree of the alarm of ECG parameters. Four options are provided: <**OFF**>, <**LOW** >, <**MID** >, <**HIGH** >.
LEAD TYPE	Select the ECG input type. Three options are provided: <**3 leads**>, <**5 leads**>, <**AUTO**>.
HR HI	Select the upper limit of HR alarm, adjustable range: **0～300**, adjust continuously, equal or above the lower limit.
HR LO	Select the lower limit of HR alarm, adjustable range: **0～300**, adjust continuously, equal or below the upper limit.
LEAD SEL	Select the emphasized monitoring lead, whose waveform is always at the region of the first waveform region in the waveform part (except the mode that seven leads on the same screen). The leads analyzed on the ECG analyzing screen and the ECG waveforms real-time recorded are all designated here: <I>, <II>, <III>, <aVR>, <aVL>, <aVF>, <V1>, <V2>, <V3>, <V4>, <V5>, <V6>.
GAIN SEL	Select the gain of the ECG waveform: <**2.5mm/mV**>, <**5mm/mV**>, <**10mm/mV**>, <**20mm/mV**>, <**40mm/mV**>.
MODE SEL	There are four operation modes, which are diagnosis, operation, monitoring and user. As real-time recording, they are identified as: <**DIAG**> , <**OPS**> , <**MON**> , <**USER**>.
EMG	The low pass filter in order to filtrate the EMG noise. Three options are provided: <**OFF**>, <**ON**>.
HUM	The notch filter in order to filtrate the HUM noise. Three options are provided: <**OFF**>, <**ON**>.
DRIFT	Drift filter. Three options are provided: <**OFF**> (time-constant > 3.2 seconds, the comeback time of ECG waveform is long, and the distortion of the waveform is little), <**Drift 1**> (time-constant > 0.3 second, the comeback time of ECG waveform is shorter), <**Drift 2**> (time-constant > 0.15 second, the comeback time of ECG waveform is shortest, and the distortion of the waveform is obvious).
SAVE WAVE	Store the waveform data of the emphasized monitoring lead which is about to do the ECG analysis, until it has been stored for 10 minutes, or until the user stop storing the waveform by press the icon. The waveform stored will be deleted at next time of storing waveform.
STOP STORE	Stop the current manipulation of storing ECG waveform.
REVIEW	Review the ECG waveform data stored before.

ARR	Setup Arrhythmia Analysis parameters.

The states of the filter under various modes of ECG:

Filter / ECG mode	Drift filter	HUM filter	EMG filter
DIAG	OFF	OFF	OFF
OPS	Drift 2	ON	ON
MON	Drift 1	ON	OFF
USER	Optional	Optional	Optional

Annotate：When setting the waveform color and data, the corresponding color varies along with the process of turning the dial to choose color.

Note：Under the mode of DIAG, OPS and MON, the state of the filter cannot be regulated. Only under the state of USER can the state be regulated.

Select <**Review**> option, the table below will be displayed (Fig. 5-1-6.2) to replay the ECG data stored.

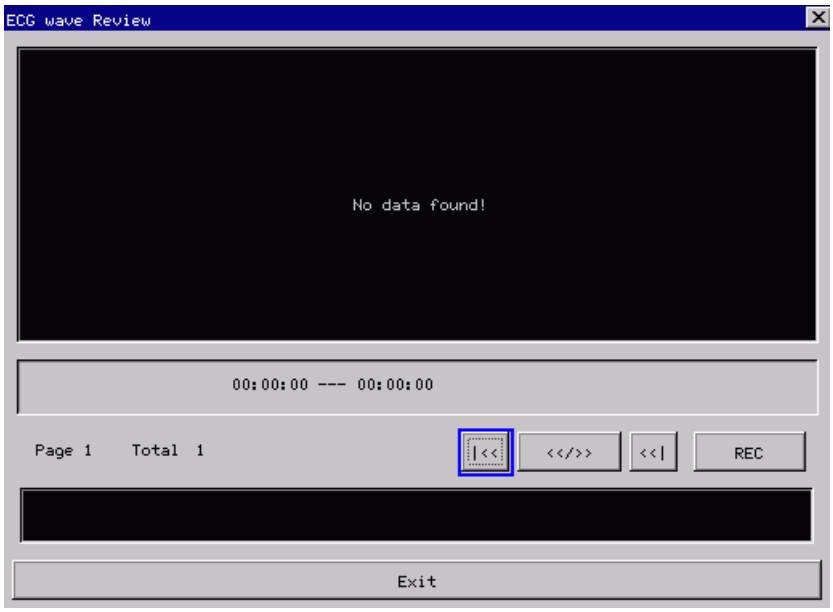


Fig. 5-1-6.2 Review the ECG waveform

|<<: Turn to the first page of ECG waveform.

>>|: Turn to the last page of ECG waveform.

<</>>: Select this button, turn to the previous page or the latter one by wheeling the

plate.

REC: Output the ECG waveform on the current screen from the recorder.

Instruction：The user could set the options above according to the need. If you want to come back to the original setting, you could make it by select <Main> → <System Info…> → <Default System>.

5.1.7 Functions of Arrhythmia Analysis

Functions of arrhythmia analysis include ST phase analysis and arrhythmia analysis. Arrhythmia analysis can identify more than 17 kinds of abnormal ECG, as listed in the following table:

Type of arrhythmia	Type of applicable patients	Conditions for occurrence	Indication	Alarm grade
ASYSTOLE	All	There is no QRS wave for 4 consecutive seconds.	Arrest (ASY)	Customer option
*VENT FIB	Without pacemaker	Consistent 4-second fibrillatory wave (350 to 600 times per min)	Ventricular fibrillation (VFIB)	Customer option
*VENT TACHY	Without pacemaker	Consistent ventricular pulsating is more than the upper limit of ventricular pulsating in strings (>=5), and its R-R pause is less than 600ms.	Ventricular tachycardia (VTA)	Customer option
UVPB	Without pacemaker	Single UVPB	UVPB	Customer option
COUPLET	Without pacemaker	Two couplets	CPT	Customer option
PVCS BIGEMINY	Without pacemaker	Ventricular bigemina	Ventricular bigemina (BGM)	Customer option
PVCS TRIGEMINY	Without pacemaker	Ventricular trigemina	Ventricular trigemina (TGM)	Customer option
RONT	Without pacemaker	HR less than 100, R-R pause less than 1/3 mean gap, followed by a compensatory pause, with a length of 1.25×mean R-R pause	RONT	Customer option
VPB	Without pacemaker	VPB that does not belong to the above	Single ventricular premature beat（VPB）	Customer option

TACHY	All	Consistent 5 QRS wave; R-R pause is less than 0.5 second.	Tachycardia (TAC)	Customer option
BRADY	All	Consistent 5 QRS wave; R-R pause is more than 1.5 second.	Bradycardia (BRD)	Customer option
MISSED BEATS	Without pacemaker	When HR is less than 100/min, no heartbeat is detected during the period of mean R-R pause× 1.75; or when HR is more than 100/min, no heartbeat is detected within 1 second.	Missed beats (MIS)	Customer option
PNP	With pacemaker	Within the period of mean R-R pause × 1.75, there is no QRS wave and generating pulse (only applicable to the patients with pacemaker).	Pacemaker not pulsating (PNP)	Customer option
PNC	With pacemaker	In case of generating pulses, within the period of mean R-R pause × 1.75, there is no QRS wave (only applicable to the patients with pacemaker).	Pacemaker not capturing (PNC)	Customer option
ST EPRESS	Without pacemaker	Depress of ST phase is more than 0.2mv (DEFAULT).	Depress of ST phase	Customer option
ST LEVATE	Without pacemaker	Elevation of ST phase is more than 0.2mv (DEFAULT).	Elevation of ST phase	Customer option
NOISE	All	Abnormal ECG wave	Noise (NOS)	Customer option

Press **ARR** button in **ECG Setup** window, a window will appear as shown below (Fig. 5-1-6.3):

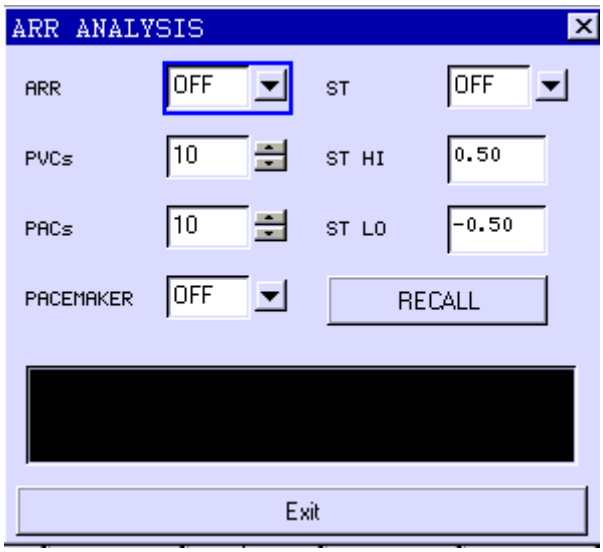


Fig. 5-1-6.3 Arrhythmia Analysis

ARR analysis Only when "On" is selected, the monitor will conduct arrhythmia analysis.

PVCs Only when the times of consistent occurrence <1 ~ 10> is selected, the monitor will send out alarm for multiple ventricular premature beats.

PACs Only when the times of consistent occurrence <1 ~ 10> is selected, the monitor will send out alarm for number of premature beats.

Pacemaker analysis Only when "On" is selected, the monitor will conduct analysis on the patients with pacemaker.

ST analysis Only when "On" is selected, the monitor will conduct analysis of ST phase.

ST upper limit **The upper limit for ST phase, the unit is mV.**

ST lower limit **The lower limit for ST phase, the unit is mV.**

Arrhythmia Review Open the dialogue box of arrhythmia review. Each display shows the arrhythmia data of 8s, i.e. 4-second ECG waveforms before and after the occurrence of abnormality. It can store a maximum of 128 groups of abnormal data for inquiry. The window is shown in the figure below (Fig. 5-1-6.4):

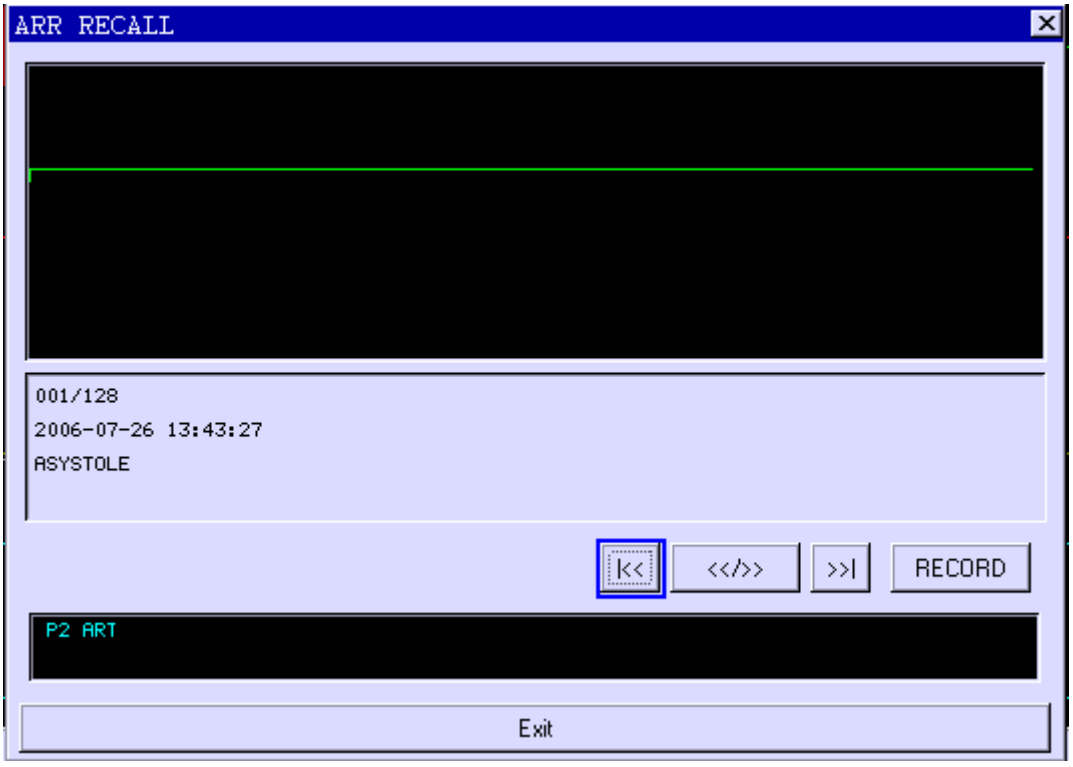


Fig. 5-1-6.4 Arrhythmia Review

|<< Previous abnormal waveform record.

>>| Next abnormal waveform record.

<</>> When this button is selected, moving to the previous/next record can be done through turning the dialing button.

Record Output of ECG waveform of the current screen from the recorder.

Attention: When "3 Lead" is selected as <Lead Type>, ECG is in 3-lead input mode, and only Lead I, II or III can be measured. Select the lead to be measured in <Monitoring Lead>, and only one ECG waveform will be displayed on screen.

Attention: When "5 Lead" is selected as <Lead Type>, ECG is in 5-lead input mode, and Lead I, II, III, aVR, aVL and aVF and one chest lead can be measured at the same time; if chest lead ECG cable is connected, V1~V6 can be measured at the same time.

5.1.8 Maintenance and Cleaning

If there is any sign that the ECG cable may be damaged or deteriorated, replace it with a new one instead of continuing its application on the patient.

Cleaning: Use fine-hair cloth moistened in mild soap or cleaning agent containing 70% ethanol to clean the equipment.

Sterilization: To avoid extended damage to the equipment, sterilization is only recommended when stipulated as necessary in the hospital maintenance schedule, sterilization facilities should be cleaned first.

Recommended sterilization material:

- Ethylate: 70% alcohol, 70% isopropanol
- Acetaldehyde

Disinfection: To avoid extended damage to the equipment, disinfection is only recommended

When stipulated as necessary in the Hospital Maintenance Schedule. Disinfection facilities should be cleaned first.

5.2 Measurement of RESP

5.2.1 Principles of Measuring

Multi-parameter Monitor measures RESP with the method of impedance. When a patient exhales and inhales, changes will take place in the size and shape of the thoracic cavity, causing consequent changes in the impedance between the two electrodes installed at the patient's chest. Based on the cycle of impedance changes, the respiration rate can be calculated. The measuring range of respiration rate is 0~120 times/min.

5.2.2 Preparatory Steps of the Measurement of RESP

1) Plug the 5-lead ECG cable into the ECG socket on the right panel of the monitor.

2) Place the various pads of the electrodes onto the body of patient and connect them to the relevant lead cables. At this moment, the screen will show RESP waves and the RESP rate will be calculated.

3) Set the parameters relevant to RESP monitoring.

5.2.3 Connect the ECG Cable with Patient and the Monitor

To measure RESP parameters, it is unnecessary to use other cables and it is only necessary to use the two RA and LL leads in the 5-lead ECG cable. So please refer to Fig. 5-1-4 to plug the 5-lead ECG cable into the CH1 ECG socket on the right panel and refer to Fig. 5-1-5 to place the RA and LL leads onto the body of patient.

Warning: For the sake of safety, all the leads on the 5-lead ECG cable must be connected to the body of patient.

5.2.4 Setup of RESP parameters

Select <**RESP**> in the **System Menu**, a following window (Fig.4-5-4) will be displayed. Setup relevant RESP parameters.

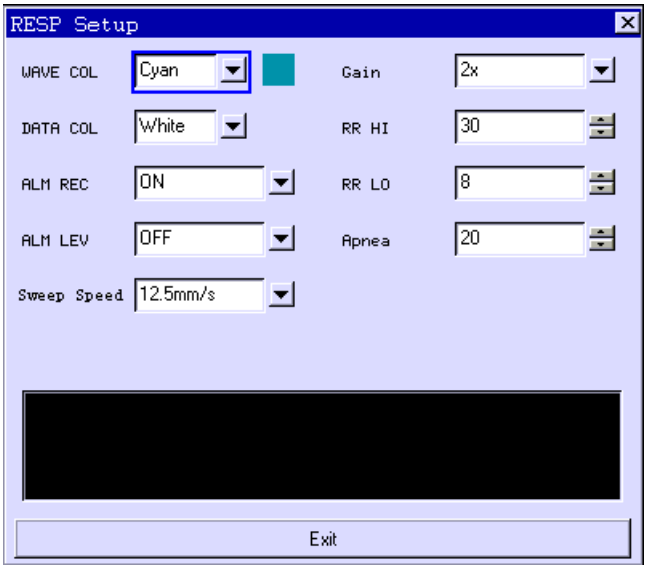


Fig. 5-2-4 Setup of RESP parameters

WAVE COL	Select the color of RESP waveform displayed on the screen.
DATA COL	Select the color of RESP data displayed on the screen.
ALM REC	Select <**ON**>, switch on alarm print output of RESP waveform and respiration rate. Select <**OFF**>, switch off alarm print output of RESP waveform and respiration rate.
ALM LEV	Setup alarm level of RESP parameters. Four levels, <**OFF**>, <**LOW**>, <**MID**>, <**HIGH**>, are optional.
Sweep Speed	Set the sweep speed of RESP waveform. Options are <**25mm/s**> , <**12.5mm/s**>, <**6.25mm/s**>.
Gain	Select the magnify times of RESP gain. Options: <**1x**>, <**2x**>, <**4x**>.
RR HI	Select the alarm upper limit of RESP rate. Range: **0～120,** adjust continuously, equal or above the lower limit.
RR LO	Select the alarm lower limit of RESP rate. Range: **0～120,** adjust continuously, equal or below the upper limit.
Apnea	Define the concept of choke. When the duration of no RESP reach this limit, alarm will be triggered. Range: 1~60s. Set "0" will disable the Apnea alarm.

Note：The user could set the options above according to the need. If you want to come back to the original setting, you could make it by select <Main> → <System Info…> → <Default System>.

5.2.5 Maintenance and Cleaning

No special operation demanded. Please refer to 5.1.7 of chapter 5.

5.3 Measurement of SpO2/Pulse

5.3.1 Principles of Measuring

The measurement of degree of blood oxygen saturation (also known as pulse oxygen saturation, usually shortened as SpO_2) adopts the principles of light spectra and volume tracing. The LED emits lights with two specific bandwidths, which are selectively absorbed by hemoferrum and desoxyhemoglobin. The optical receptor measures the changes in the light intensity after the light passes the capillary network and estimates the ratio of and the total hemoglobin. The measurement range of SpO_2 is 0~100%.

$$\text{Degree of pulse oxygen saturation \%} = \frac{\text{hemoferrum}}{\text{hemoferrum} + \text{desoxyhemo globin}} \times 100\%$$

Abnormal hemoglobin, carboxyhemoglobin, oxidative hemoglobin are not directly measured, for they are not the affecting factors in the measurement of SpO_2

Multi-parameter Monitor adopts FFT filter and signal correlation techniques to deal with Spo2 module's pulse waveform signals. Before the measurement of SpO_2, the noise produced in the false trace is smoothed so as to the eliminate disturbance in the measurement of saturation. In case of weak blood pulse, the noise produced by some confinements of electrical properties is greatly reduced.

5.3.2 Preparatory Steps before the Measurement of SpO2/Pulse

1) Plug the SpO_2 sensor cable into the SpO_2 socket on the right panel of the monitor.

2) Put the SpO_2 sensor onto the finger of the patient, and the screen should display SpO_2 waveforms, and the SpO_2 value and pulse rate should be calculated.

3) Set up the parameters relevant to SpO_2 and pulse monitoring.

5.3.3 Connecting to Patient and Monitor

Refer to Fig.1-2 and plug the SpO_2 sensor cable into the socket marked with SpO_2, then put the sensor onto the finger of the patient, as shown in Fig. 5-3-3.

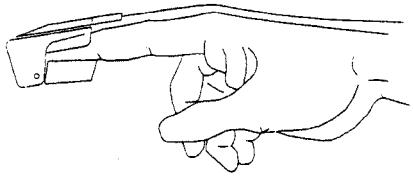


Fig. 5-3-3 Connection of SpO_2 sensor with the patient

After the SpO_2 sensor is connected to the patient, the screen shall display SpO_2 waveforms and then it shall calculate the SpO_2 value and pulse rate value.

Attention: In case it is necessary to add a clip to fix the fingertip sensor, the cable instead of the sensor itself should be clipped. Please note that the cable of sensor should not be pulled with force.

Note: Frequent movements of the sensor may result in errors in the readings of the monitor.

Warning: In case NIBP and SpO_2 are measured at the same time, please do not place the SpO_2 sensor and the NIBP cuff on the same end of the limb, for the measurement of NIBP will block blood flow, affecting the measurement of SpO_2.

Warning: Do not conduct SpO_2 measurement on the finger smeared with fingernail oil, otherwise unreliable measurement results might be produced.

Note: When using SpO_2 sensor, care should be taken to shield external light sources, such as light of thermo therapy or ultraviolet heating light, otherwise the measurements may be disturbed. Under such conditions as shock, hypothermia, anemia or the use of blood vessel-activating drugs, and with the existence of such substances as carboxyhemoglobin, methemoglobin, methylene blue the result of the SpO_2 measurement will be possibly not accurate.

Notes:

- **Make sure the nail covers the light window.**
- **The wire should be on the backside of the hand.**
- **SpO2 waveform is not proportional to the pulse volume.**

Warning: Do not use the sterile supplied SpO2 sensors if the packing or the sensor is damaged and return them to the vendor.

Warning: Prolonged and continuous monitoring may increase jeopardy of unexpected change of dermal condition such as abnormal sensitivity, rubescence, vesicle, repressive putrescence, and so on. It is especially important to check the sensor placement of neonate and patient of poor perfusion or immature dermogram by light collimation and proper attaching strictly according to changes of the skin. Check per 2 ~ 3 hours the sensor placement and move it when the skin deteriorates. More frequent examinations may be required for different patients.

5.3.4 Setup of SpO2/Pulse parameters

Select <**SpO2**> button in **System Menu**, then will present a screen as follow (Fig.5-3-4). We can set the SpO2/Pulse parameters.

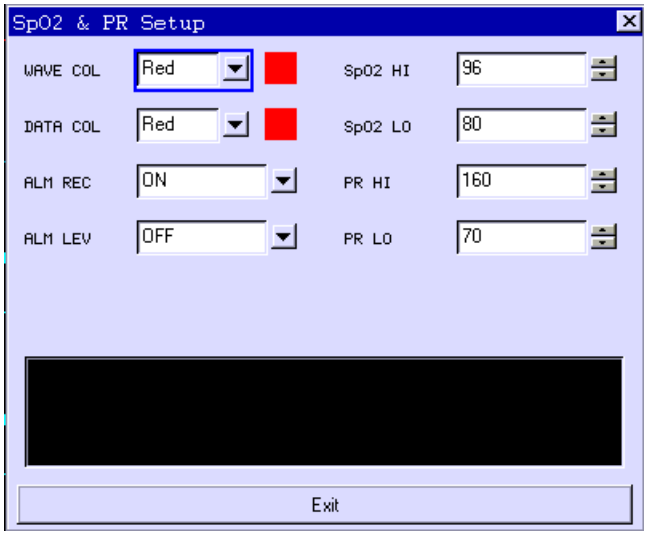


Fig.5-3-4 Setup of SpO2/Pulse parameters

WAVE COL	Select the blood oxygen waveform color presented on the screen.
DATA COL	Select the blood oxygen and pulse data color presented on the screen.
ALM REC	Select <**ON**>, switch on alarm print output of SpO2 waveform and SpO2 data. Select <**OFF**>, switch off alarm print output of SpO2 waveform and SpO2 data.

ALM LEV	Setup alarm level of SpO2 parameters. Four levels, <**OFF**>, <**LOW**>, <**MID**>, <**HIGH**>, are optional.
SpO2 HI	Select the SpO2 alarm high limit, range: **0~100**, adjust continuously, equal or above the lower limit.
SpO2 LO	Select the SpO2 alarm low limit, range: **0~100**, adjust continuously, equal or below the upper limit.
PR HI	Select the PR alarm high limit, range: **0~255**, adjust continuously, equal or above the lower limit.
PR LO	Select the PR alarm low limit, set range: **0~255**, adjust continuously, equal or below the upper limit.

Note：The user could set the options above according to the need. If you want to come back to the original setting, you could make it by select <Main> → <System Info…> → <Default System>.

5.3.5 Maintenance and Cleaning

Warnings:

- **Do not subject the sensor to autoclaving.**
- **Do not immerse the sensor into any liquid.**
- **Do not use any sensor or cable that may be damaged or deteriorated.**

For cleaning:

Use a cotton ball or a soft mull moistened with hospital-grade ethanol to wipe the surface of the sensor, and then dry it with a cloth. This cleaning method can also be applied to the luminotron and receiving unit.

The cable can be cleaned with 3% hydrogen dioxide, 7% isopropanol, or other active reagent. However, connector of the sensor shall not be subjected to such solution.

Disposal Notice: When disposing the disposable SpO2 probe or useless SpO2 probe, please observe all local, state, and federal regulations that relate to the disposal of this products or similar products.

5.4 Measurement of TEMP

5.4.1 Brief Introduction to Measurement of TEMP

Multi-parameter Monitor measures TEMP with TEMP sensors, and the measurement range is 0.0ºC~50.0ºC (32.0ºF~122.0ºF).

The TEMP module of Multi-parameter uses TEMP cable compatible with YSI-4400, which can be used repeatedly.

Multi-parameter monitor has two ports for body TEMP measurement, and can measure the temperature of two channels at the same time.

5.4.2 Preparatory Steps of the Measurement of TEMP

1) Plug the TEMP cables into the TEMP sockets on the right panel of the monitor.

2) Place the TEMP sensors on body of patient and the screen will show the value of TEMP measurement.

3) Set the parameters relevant to TEMP.

5.4.3 Connecting Patient and Monitor

Refer to Fig. 1-2 and plug the TEMP cable into the sockets marked with TEMP (either of TEMP1 and TEMP2), and then stick the TEMP sensor securely onto the body of patient.

Attention: The TEMP sensor and cables should be handled with care. When not in use, the sensor and the cable should be round into loose ring shape.

5.4.4 Setup of TEMP Parameters

Select <**TEMP**> button in **System Menu**, then will present a screen as follow (Fig. 5-4-4). We can set the TEMP parameters.

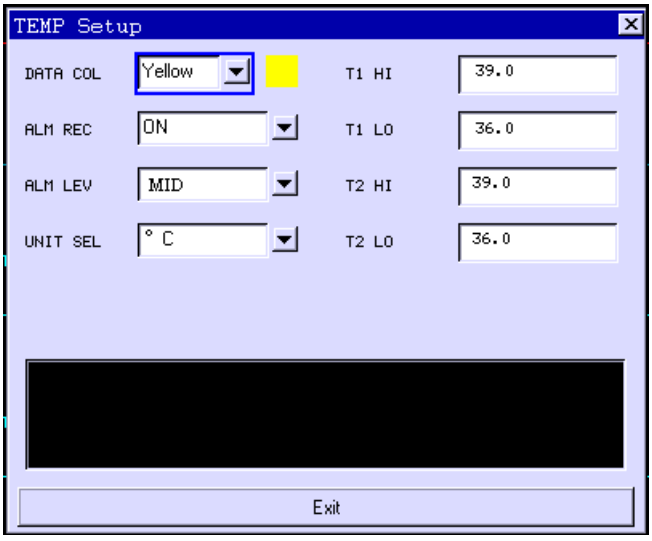


Fig.5-4-4 Setup of TEMP parameters

DATA COL	Select the TEMP data's color presented on the screen.
ALM REC	Select <**ON**>, and open the temperature data alarm print output. Select <**OFF**>, and close the temperature data alarm print output.
ALM LEV	Set TEMP parameters' alarm level, there are four levels: <**OFF**>, <**LOW**>, <**MID**>, <**HIGH**>.
UNIT SEL	Select the unit of the measured TEMP value, options contain: <℃>, <℉>.
T1 HI	Select the channel 1 TEMP alarm high limit, set range: **0~50℃**, adjust continuously, equal or above the lower limit.
T1 LO	Select the channel 1 TEMP alarm low limit, set range: **0~50℃**, adjust continuously, equal or below the upper limit.
T2 HI	Select the channel 2 TEMP alarm high limit, set range: **0~50℃**, adjust continuously, equal or above the lower limit.
T2 LO	Select the channel 2 TEMP alarm low limit, set range: **0~50℃**, adjust continuously, equal or below the upper limit.

Note：The user could set the options above according to the need. If you want to come back to the original setting, you could make it by select <Main> → <System Info…> → <Default System>.

5.4.5 Maintenance and Cleaning

Reusable temp probes

1. The temp probe should not be heated above 100℃. It should only be subjected briefly to temperatures between 80℃ and 100℃.
2. The probe must not be sterilized in steam.
3. Only detergents containing no alcohol can be used for disaffection.
4. The rectal probes should be used, if possible, in conjunction with a protective rubber cover.
5. To clean the probe, hold the tip with one hand and with the other hand rubbing the probe down in the direction of the connector sing a moist lint-free cloth.

Warning: Disposable TEMP probes must not be re-sterilized or reused.

Note: For protecting environment, the disposable TEMP probe must be recycled or disposed of properly.

Disposal Notice: Should the TEMP probe become damaged beyond repair, or for some reason its useful life is considered to be at an end, please observe all local, state, and federal regulations that relate to the disposal of this products or similar products.

5.5 Measurement of NIBP

5.5.1 Brief Introduction to Measurement of NIBP

Multi-parameter Monitor automatically conducts measurement of NIBP with the method of shockwave. The method of shockwave indirectly estimates the systolic and diastolic pressures within the blood vessels by measuring the change of the pressure within blood pressure cuff along with the volume of the arteries and calculates the average pressure.

A measurement time of BP on a calm patient less than 40s, and when each measurement ends, the cuff automatically deflates to zero.

Multi-parameter monitor applies to any standards of the cuffs for neonate, child and adult (including the cuffs used for arms and legs).

The monitor measures the blood pressure during the time of deflation. Multi-parameter Monitor automatically conducts the second and third inflation measurements in case during the first inflation it is unable to measure the value of BP, and gives out the information for measurement failures.

The maximum cuff pressure allowed by adult mode is 315mmHg±10mmHg, and the maximum cuff pressure allowed by child mode is 255mmHg±10mmHg, and the maximum cuff pressure allowed by neonate mode is 170mmHg±10mmHg.

The longest cuff pressure maintaining duration is 90 seconds, and when the time is exceeded, the air will be deflated automatically. The monitor has been designed with hardware protection circuit regarding overpressure, errors of microprocessors, and the occurrence of power failure.

5.5.2 Preparatory Steps of Measurement of NIBP

1) Plug the air tube of the cuff into the NIBP socket on the right panel of the monitor and tighten it clockwise to ensure secure contact of the plug and the socket (Please note that the plug should be loosened by turning counterclockwise first before unplugging).

2) Tie the cuff on the arm of patient.

3) Set the parameters and modes relevant to NIBP.

Note: Make sure that the air conduit connecting the blood pressure cuff and the monitor is neither blocked nor tangled, and avoid compression or restriction of air conduit.

5.5.3 Connecting to Patient and the Monitor

Refer to Fig. 1-2 to plug the cuff into the socket marked with NIBP and install the cuff onto the arm of patient. Make sure the mark of Φ on the cuff is placed on the femoral artery of the arm and the air tube should be below the cuff so as to ensure the air tube is not snarled after coming out of the cuff. The white line on the cuff should be within the range of " ⟺ ", otherwise it will be necessary to replace it with a more suitable cuff (smaller or bigger one). The cuff should be placed on the same plane with the heart so as to prevent the errors in readings caused by the effects of hydrostatics of the blood column between the heart and the cuff. If the position of the cuff is higher than the plane of heart, the measured BP readings tend to be smaller; in case the position of the cuff is lower than the plane of the heart, the measured BP readings tend to be higher.

Note: The accuracy of measurement of BP depends on the suitability of the cuff. Select the size of the cuff according to the size of the arm of patient. The width of the cuff should be 40% of the circumference of the upper arm or 2/3 of the length of the upper arm.

Warning:

- **You must not perform NIBP measurements on patients with sickle-cell disease or under any condition that the skin is damaged or expecting to be damaged.**
- **For a thrombasthemia patient, it is important to determine whether measurement of the blood pressure shall be done automatically. The determination should be based on the clinical evaluation.**

- **Prolonged non-invasive blood pressure measurements in Auto mode be associated with purport, ischemia and neuropathy in the limb wearing the cuff. When monitoring a patient, examine the extremities of the limb frequently for normal color, warmth and sensitivity. If any abnormality is observed, stop the blood pressure measurements.**

5.5.4 Setup of NIBP Parameters

Select <**NIBP**> button in **System Menu**, then will present a screen as follow (Fig. 5-5-4.1). We can set the NIBP parameters.

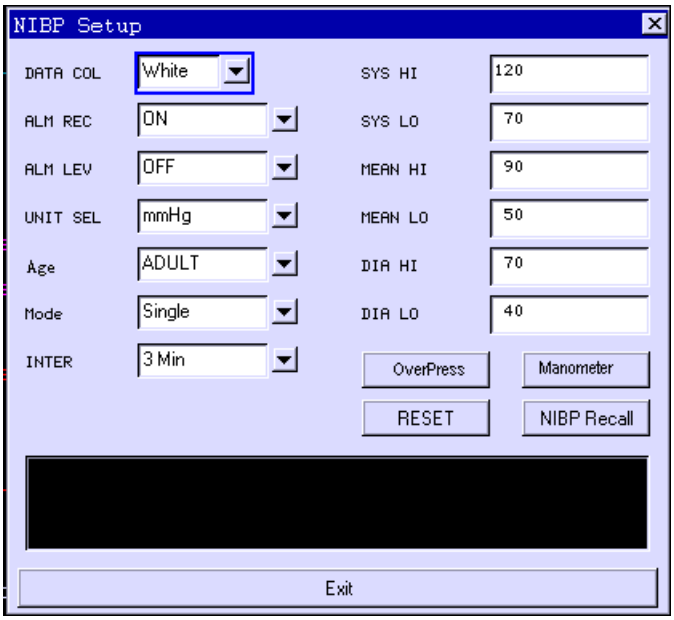


Fig.5-5-4.1 Setup of NIBP parameters

DATA COL	Selects the color of data of NIBP displayed in the screen.
ALM REC	Selects <ON> to open the warning print of NIBP data, the detail is in the introduction of warning print. Selects <OFF> to close the warning print of NIBP data.
ALM LEV	Set NIBP parameters' alarm level, there are four levels: <OFF>, <LOW>, <MID>, <HIGH>.
UNIT SEL	Selects the units of NIBP measurement value , option : <kPa> <mmHg>.
Age	Set the measurement object , option : <ADULT> , <CHILD> , <NEON> (neonate) , <HYPER> (hypertension) .
MODE	Selects the measurement mode. There are three kinds of modes as <SINGLE>, <CYCLE> and <QUICK> mode. If the quick mode is

	selected, the system will set automatically as single at the end of quick measurement. No quick mode for neonates.
INTER	The option for the cycle intervals is 1，2，3，4，5，10，15，20，30，45，60，90s，2，4，8h.
SYS HI	Selects the warning upper limit of systolic blood pressure, the range is 0～300 mmHg continuously, and can not lower than the lower limit.
SYS LO	Selects the warning lower limit of systolic blood pressure, the range is 0～300 mmHg continuously, and can not higher than the upper limit.
MEAN HI	Selects the warning upper limit of mean blood pressure, the range is 0～300 mmHg continuously, and can not lower than the lower limit.
MEAN LO	Selects the warning lower limit of mean blood pressure, the range is 0～300 mmHg continuously, and can not higher than the upper limit.
DIA HI	Selects the warning upper limit of diastolic blood pressure, the range is 0～300 mmHg continuously, and can not lower than the lower limit.
DIA LO	Selects the warning lower limit of diastolic blood pressure, the range is 0～300 mmHg continuously, and can not higher than the upper limit.
Over press	Select this option will configure NIBP module work at overpressure protection test mode. This option is only used at periodic check or maintenance.
Manometer	Select this option will configure NIBP module work at manometer test mode. This option is only used at periodic check or maintenance.
RESET	Select this option will reset NIBP module. This option is only used at periodic check or maintenance.
NIBP Recall	Recall the NIBP measurement data stored before.

To do Overpress and Manometer check, according to fig 5-5-6.

Note: NIBP check should be done evening two years, or according to the rules and regulations the hospital.

Note: Cycle measurement method means the system automatically activates the air pump to conduct measurement according to the set intervals of cycles; single measurement method means the user starts the air pump manually to conduct measurement, and QUICK measurement means the system will swiftly and continuously measure BP within 5 minutes. QUICK is

invalid for NEON.

Note：The user could set the options above according to the need. If you want to come back to the original setting, you could make it by select <Main> → <System Info…> → <Default System>.

Note: While measuring hypertension patient, please set < Age> on < HYPER >, So NIBP can go up automatically to a higher pressure to start measuring, Reduce the times of inflation, get the blood pressure value of hypertension patient more quickly and accurately.

Selects **NIBP Recall** and the window as the following window will display (Fig.5-5-4.2).

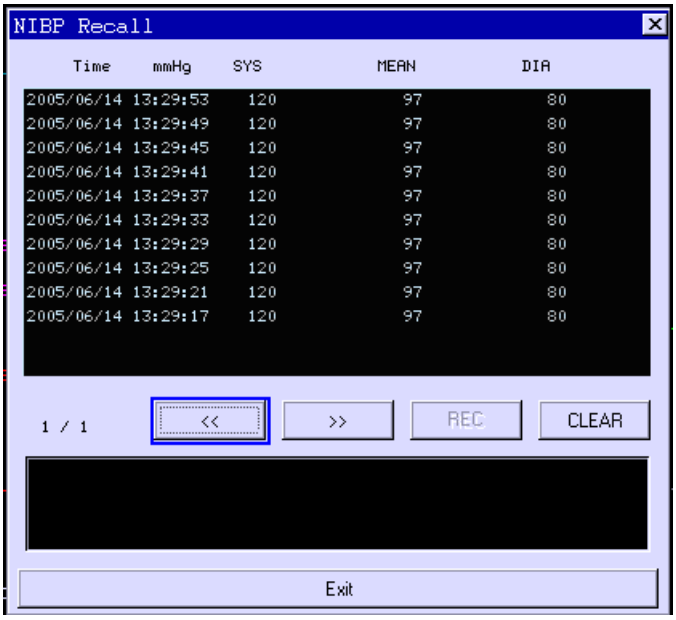


Fig.5-5-4.2 NIBP Recall

In the NIBP measurement recall figure, rotate the dial to move the cursor to the last page and press the dial, the information in the last page can be seen. Rotate the dial to move the cursor to the next page and press the dial, the information in the next page can be seen.

Rotate the dial to move the cursor to the "**REC**" and press the dial, the history data of NIBP on the present window can be outputted.

5.5.5 Precautions during Measurement

▭ If the BP of the patient is above 180mmHg, <HYPER> measurement mode is recommended.

▭ When using the QUICK measurement or cycle measurement, if the time duration is relatively long, care must be taken to check such abnormalities as purple spots, coldness and numbness at the limb end. If there are such phenomena, the cuff should be relocated or the measurement of NIBP should be halted. **To neonate mode, QUICK measurement is unavailable.**

▭ The presence of factors that change the properties of the cardiovascular dynamics of patient will adversely affect the measurement value of the monitor, and shock and hypothermia will also affect the accuracy of the measurement.

▭ When the built-in main artery balloon pump is applied on the patient, the measurement value of NIBP will be affected.

▭ For the limb that is on an intravenous drip or in a catheter insertion, or if the patient is connected to the heart-lung machine, or the patient is experiencing shiver or convulsions, the measurement of NIBP cannot be conducted.

▭ When errors occur in the measurement of NIBP, the error codes will appear in the parameter display zone of the NIBP, and for the cause of the errors, please refer to **Appendix A Notes on Code of the NIBP Error Information**.

5.5.6 Periodic Check

▭ **Calibration**

Warning: The calibration of the NIBP measurement is necessary for every two years (of as frequently as dictated by your Hospital Procedures Policy). The performance should be checked according to the following details.

Procedure of the Pressure Transducer Calibration:

1) Replace the cuff of the device with a rigid metal vessel with a capacity of 500 ml ±5%.
2) Connect a calibrated reference manometer with an error less than 0.8mmHg and a ball pump by means of a T-piece connector and hoses to the pneumatic system.
3) Access the Set NIBP menu.
4) Turn the dial to the **Manometer** item and press. Then the NIBP module will work at manometer test mode to start performing calibration.
5) Inflate the pneumatic system to 0, 50 and 200 mmHg by ball pump separately. The difference between the indicated pressure of the reference manometer and the

indicated pressure of the monitor will not exceed 3mmHg. Otherwise, please contact our customer service.

6) Press the STOP button on front panel can stop the calibration.

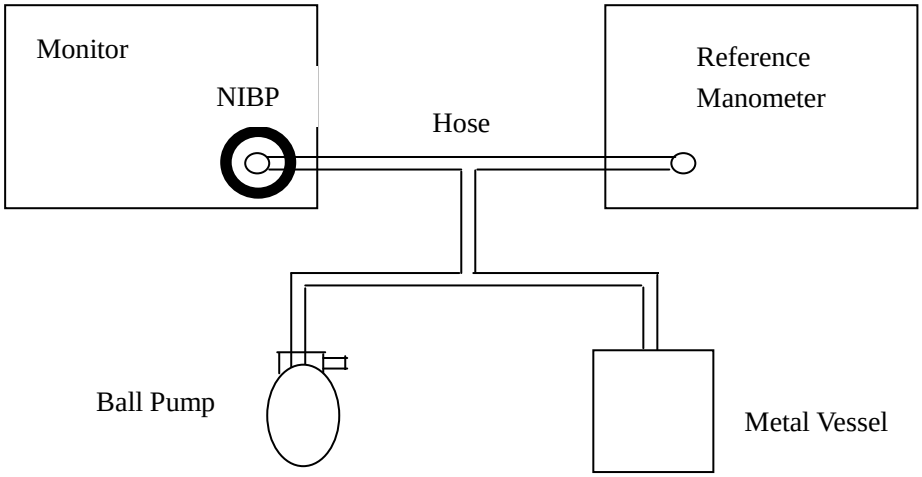


Fig. 5-5-6 Diagram of NIBP calibration

5.5.7 Maintenance and Cleaning

Warning: Do not squeeze the rubber tube on the cuff. Do not allow liquid to enter the connector socked at the front of the monitor. Do not wipe the inner part of the connector socked when cleaning the monitor.

Warning: if liquid is inadvertently splashed on the equipment or its accessories, or may enter the conduit or inside the monitor, contact local customer service center.

When the reusable cuff is not connected with the monitor, or being cleaned, always place the cover on the rubber tube to avoid liquid permeation.

- **Reusable Blood Pressure Cuff**

The cuff can be sterilization be means of conventional autoclaving, gas, or radiation sterilization in hot air ovens or disinfected by immersion in decontamination solutions, but remember to remove the rubber bag if you use this method. The cuff should not be

dry-cleaned.

The cuff can also be machine-washing or hand-washing, the latter method may prolong the service life of the cuff. Before washing, remove the latex rubber bag, and for machine-washing, close the Velcro fastening. Leave the cuff to dry thoroughly after washing, then reinsert the rubber bag.

To replace the rubber bag in the cuff, first place the bag on top of the cuff so that the rubber tubes line up with large opening on the long side of the cuff. Now roll the bag lengthwise and insert it into the opening on the long side of the cuff. Hold the tubes and the cuff and shake the complete cuff until the bag is in position. Thread the rubber tubes from inside the cuff, and out through the small hole under the internal flap.

- **Disposable blood pressure cuffs**

Disposable cuffs are intended for one-patient use only. Do not use the same cuff on any other patient. Do not sterilize or use autoclave on disposable cuffs. Disposable cuffs can be cleaned using soap solution to prevent infection.

Disposal Notice: Should the blood pressure cuff become damaged beyond repair, or for some reason its useful life is considered to be at an end, please observe all local, state, and federal regulations that relate to the disposal of this products or similar products.

5.6 Measurement of IBP

5.6.1 Brief Introduction to Measurement of IBP

The method of IBP measurement is direct measuring the BP of artery or veins on the pressure sensor mainly through liquid coupling so as to obtain the pressure curve of the continuous BP.

The IBP parameters of Multi-parameter Monitor can select Arterial Pressure (ART), Pulmonary Artery pressure (PA), Left Atrium Pressure (LAP), Right Atrium Pressure (RAP), Central Venous Pressure (CVP), Intracranial Pressure (ICP).

Multi-parameter has two measurement channels for IBP, and the IBP of two channels can be measured at the same time.

5.6.2 Preparatory Steps for Measurement of IBP

1) Plug the cable of IBP into the IBP socket (either CH1 or CH2), take off he blue cover of the energy converter, do a touching test to make sure the converter work normally.

Put the blue cover connecting to the extension tube on the surface of the energy converter. Fill the ball cover of the energy converter and extension tube with saline water mixed with heparin. Press the flexible valve to expel the saline water from the air outlet to expel air bubbles, and then reset it to zero.

Note: The method of touching test is to touch slightly the surface with finger. Waveforms should appear on the screen of the main unit. The blue ball cover should be put on the surface immediately when the energy converter is not used.

Note: Anytime the user applies a new transducer, it should be verified or periodically verified according to the hospital operating rules.

Warning: single-time used pressure transducer mustn't be used again. And it must be used before expired data. Do read the expired data on the IBP accessory package bag.

Warning: when the monitor is used with HF surgical equipment, the transducer and the cables must be avoided conductive connection to the HF equipment to protect against burns to the patient.

The specified transducer is designed to protect against the effects of a discharge of a cardiac defibrillator. When the patient is in the defibrillation, the waveform of IBP maybe distorted temporarily. After the defibrillation, the monitoring will go on normally, the operation mode and the user configuration are not affected.

Warning: the operator should avoid contact with the conductive parts of the appurtenance when being connected or applied.

2) Plug the cable of IBP into the IBP socket on the right panel of the monitor. Connect the extension tube of the energy converter and blood vessel with the artery needles and secure them, then make sure three-way valve 1 and three-way valve 2 (See Fig. 5-6-4) are in a state of ON. At this moment, BP waveforms should appear on the screen of the main unit.
3) Set up parameters and modes relevant to IBP.

5.6.3 Calibration of Zero-point

Start the unit and preheat it for 3 minutes. If it is in a stable state, turn off three-way valve 2 and turn on three-way valve 1, and then select items in <**Zero**> of <**IBP Setup**>, then it can be seen on the screen that the scanning baseline has returned to zero baseline.

Note: In the course of zeroing, should turn off the three-way valve near artery needle, don't connect artery needle with patient and make sure there is no air inside the whole tube.

5.6.4 Connecting to Patient

As shown in Fig. 5-6-4

Note: The pressure measuring side of the energy converter should be on the same plane as the heart of the patient in the process of zero-setting and measurement and the user should make sure there is no air inside the whole tube in order to assure the correctness of the measured results. If air is found in tube or in pressure transducer, they must be rinsed by physiological salt solution.

Warning: if liquid (not the liquid which used to douche the tubes and pressure transducers) spills on equipment or accessories, especially when the liquid is likely to enter the equipment or transducer, contacting with the maintenance department of the hospital immediately.

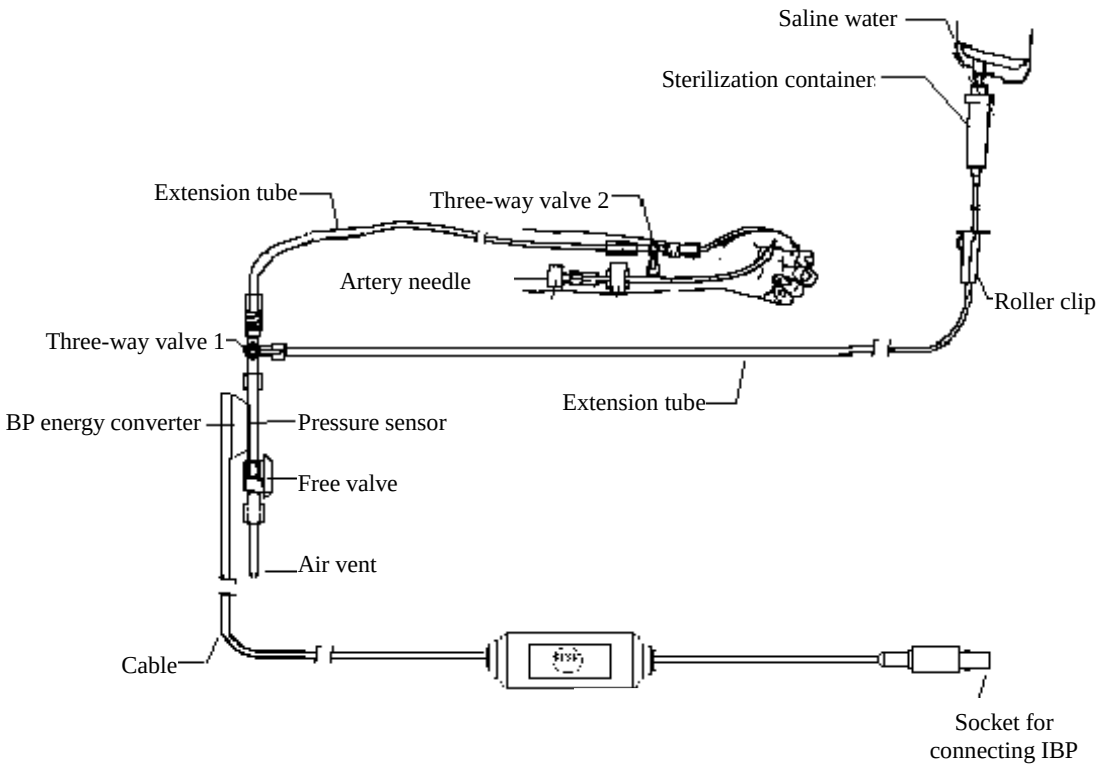


Fig. 5-6-4 Schematic diagram for installation of IBP sensor

5.6.5 Setup of Range

The setup of IBP module range can provide you with the best waveforms and the best measurement results. Based on different contents of measurement, there are two ranges for selection, and each group has 5 selection items:

·Arterial Pressure (ART):

AUTO, 0-50mmHg, 50-150mmHg, 100-240mmHg, 0-300mmHg

·Pulmonary Artery pressure (PA), Left Atrium Pressure (LAP) ,Right Atrium Pressure (RAP) ,Central Venous Pressure (CVP), Intracranial Pressure (ICP)

AUTO, 0-20mmHg, 0-30mmHg, 0-50mmHg, 0-80mmHg

Note: AUTO will adjust the scale on which the pressure waveform is displayed on the screen automatically for the best observation status.

5.6.6 Setup of IBP Parameters

Select <**IBP**> button in **System Menu**, then will present a screen as follow (Fig.

5-6-6). We can set the IBP parameters.

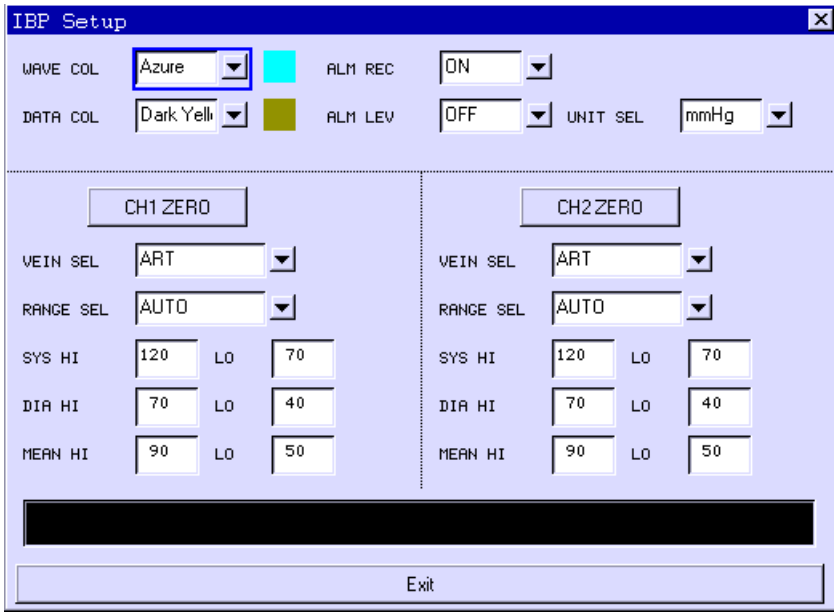


Fig.5-6-6 Setup of IBP parameters

WAVE COL	Selects the color of waves of IBP displayed in the screen.
DATA COL	Selects the color of data of IBP displayed in the screen.
ALM REC	Selects <**ON**> to open the warning print of IBP data, the detail is the introduction of warning print. Selects <**OFF**> to close the warning print of IBP data.
ALM LEV	Set IBP parameters' alarm level, there are four levels: <**OFF**>, <**LOW**>, <**MID**>, <**HIGH**>.
UNIT SEL	Selects the units of IBP measurement value , option : <**kPa**> <**mmHg**>.

Attention that the left IBP parameter is for the first channel and the right one is for the second channel.

CH1 ZERO	Perform the calibration to zero point on IBP 1.
CH2 ZERO	Perform the calibration to zero point on IBP 2.
VEIN SEL	Select the vein of IBP, option: <**ART**>, <**PA**>, <**CVP**>, <**LAR**>, <**RAP**>, <**ICP**>.
RANGE SEL	The measurement ranges setting of the IBP module can make you obtain the optimal pressure wave shape and measure result.
SYS HI	Selects the warning upper limit of systolic blood pressure, the range is **-10 ~ 300 mmHg** continuously, and can not lower than the

	lower limit.
SYS LO	Selects the warning lower limit of systolic blood pressure, the range is **-10 ~ 300 mmHg** continuously, and can not higher than the upper limit.
DIA HI	Selects the warning upper limit of diastolic blood pressure, the range is **-10 ~ 300 mmHg** continuously, and can not lower than the lower limit.
DIA LO	Selects the warning lower limit of diastolic blood pressure, the range is **-10 ~ 300 mmHg** continuously, and can not higher than the upper limit.
MEAN HI	Selects the warning upper limit of mean blood pressure, the range is **-10 ~ 300 mmHg** continuously, and can not lower than the lower limit.
MEAN LO	Selects the warning lower limit of mean blood pressure, the range is **-10 ~ 300 mmHg** continuously, and can not higher than the upper limit.

Note：The user could set the options above according to the need. If you want to come back to the original setting, you could make it by select <Main> → <System Info…> → <Default System>.

5.6.7 IBP Transducer Zero and Calibration

- **IBP Transducer Zero**

Warning: It is the responsibility of the user to ensure that a zero procedure has recently been done on the transducer, otherwise there will be no recent, valid zero value for the instrument to use, which may result in inaccurate measurement results.

Procedure of the IBP Transducer Zero:

1) Turn off patient stopcock before you start the zero procedure.
2) The transducer must be vented to atmospheric pressure before the zero procedure.
3) The transducer should be placed at the same height level with the heart, approximately mid-axially line.

4) Access the Set IBP menu.
5) Turn the dial to pick the Zero1 item (Pick the Zero2 item when zeroing channel 2 IBP) and press will start zero the transducer.
6) Wait 3 seconds for the Zeroing procedure end and the pressure value that is displayed on screen will approximately return to zero.

Attention: Zero procedure should be performed before starting the monitoring and at least once a day and whenever after each disconnect-and-connect of the cable.

■ IBP Calibration

Caution:

- Mercury calibration should be performed by the biomedical engineering department either whenever a new transducer is used, or as frequently as dictated by your Hospital Procedures Policy.
- The purpose of the calibration is to ensure that the system gives you accurate measurements.
- Before starting a mercury calibration, a zero procedure must be performed.
- If you need to perform this procedure yourself you will need the following pieces of equipment:

- Standard sphygmomanometer
- 3-way stopcock
- Tubing approximately 25 cm long

The Calibration Procedure:

Warning: You must never perform this procedure while patient is being monitored.

1) Close the stopcock that was open to atmospheric pressure for the zero calibration.
2) Attach the tubing to the sphygmomanometer.
3) Ensure that connection that would lead to patient is off.
4) Connect the 3-way connector to the 3-way stopcock that is not connected to the patient catheter.
5) Open the port of the 3-way stopcock to the sphygmomanometer.
6) Inflate to make the mercury bar rise to 0, 50 and 200 mmHg separately. The difference between the indicated pressure of the sphygmomanometer and the indicated pressure of the monitor will not exceed ±4% or ±4 mmHg, whichever is greater. Otherwise, please contact the manufacturer.
7) After calibration, disassemble the blood pressure tubing and the attached 3-way valve.

5.6.8 Maintenance and Cleaning

Cleaning of IBP Transducer (Reusable)

After the IBP monitoring operation is completed, remove the tubing and the dome from the transducer and wipe the transducer diaphragm with water. Soaking and/or wiping with soap can clean the transducer and cable and water or cleaning agents such as those listed below:

Cetylcide

Wavicide-01

Wescodyne

Cidex

Lysol

Vesphene

Do not immerse the connector in any liquid. After cleaning, dry the transducer thoroughly before storing. Slight discoloration or temporary increase of surface stickiness of the cable should not be considered abnormal if adhesive tape residue must be removed from the transducer cable, double seal tape remover is effective and will cause a minimum of damage to the cable if used sparingly. Acetone, alcohol, ammonia and chloroform, or other strong solvents are not recommended because over time the vinyl cabling will be damaged by these agents.

Sterilization

- Liquid chemical sterilization:

Remove obvious contamination by using the cleaning procedure described previously. Select a sterilant that your hospital or institution has found to be effective for liquid chemical sterilization of operating room equipment. Buffered gluteraldehyed (e.g. cidex or hosposept) has been found to be effective. Do not use quaternary cationic detergents such as zephiran chloride. If the whole unit is to be sterilized, immerse the transducer but not the electrical connector into the sterilant for recommended sterilizing period. Be sure that the dome is removed. Then rinse all transducer parts except the electrical connector with sterilized water or saline. The transducer must be thoroughly dried before storing.

- Gas sterilization:

For more complete asepsis, use gas sterilization.

Remove obvious contamination by using the cleaning procedure described previously. To inhibit the formation of ethylene oxide gas is used as the disinfectant, the transducer should be completely dry.

Follow the operating instructions provided by the manufacturer of the gas

disinfectant.

Warning: The sterilize temperature must not exceed 70 ℃. Plastics in the pressure transducer may deform or melt above this temperature.

Warning: The disposable transducers or domes must not be re-sterilized or re-used.

Note: For protecting environment, the disposable transducers or domes must be recycled or disposable of properly.

Disposal Notice: When disposing the disposable transducers or domes and tubing, please observe all local, state, and federal regulations that relate to the disposal of this products or similar products.

5.7 Measurement of Sidestream EtCO2

5.7.1 Brief Introduction to Measurement of Sidestream EtCO2

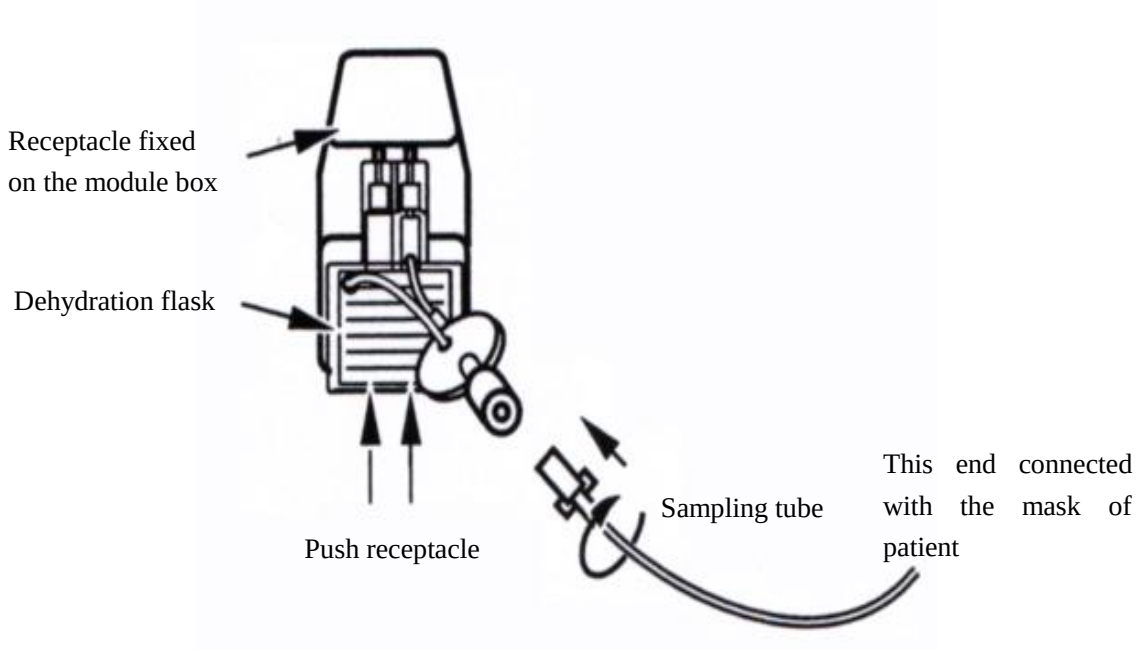


Fig.5-7-1 The installation sketch map of dehydration flask

According to the Fig. 5-7-1**,** when the dehydration flask has been connected with the plug fixed on the module, one end of the sampling tube has been linked to the mask of patient (the sampling tube's port can also been fixed on the naris of patient with adhesive plaster), and the other end has been connected with the dehydration flask, the measurement can start. **Caution: The two small holes in the module (the right of receptacle), through which air can get in or out of the dehydration flask, may not be clogged.**

- Pay attention to the water level of dehydration flask. If the highest water level reaches, Please replace the dehydration flask in time to prevent the module from soaking by water.
- When air is getting across the sampling tube, a period of time will cost. So, a delay time will appear from starting measure to showing waveform in the screen and measuring result.
- Please keep the sampling tube clean, and prevent the tube from clogging by dust.

Note：**Dehydration flasks and sampling tubes are one-off, Please use products provided or designated by Company.**

5.7.2 Setup of EtCO2 parameters

Select <**EtCO2**> button in **System Menu**, then will present a screen as follow (Fig. 5-7-2). We can set the EtCO2 parameters.

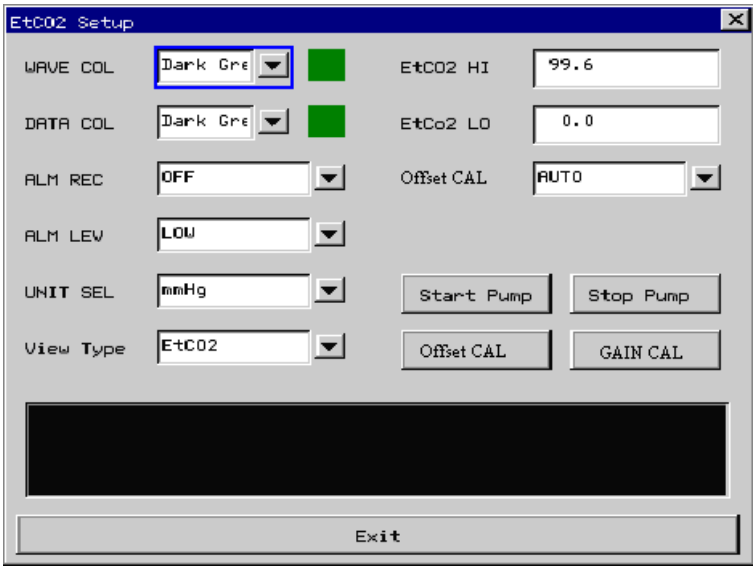


Fig.5-7-2 Setup of EtCO2 parameters

WAVE COL	Selects the color of waves of EtCO2 displayed in the screen.
DATA COL	Selects the color of data of EtCO2 displayed in the screen.
ALM REC	Selects <**ON**> to open the warning print of EtCO2 data, the detail is the introduction of warning print. Selects <**OFF**> to close the warning print of EtCO2 data.
ALM LEV	Set EtCO2 parameters' alarm level, there are four levels: <**OFF**>, <**LOW**>, <**MID**>, <**HIGH**>.
UNIT SEL	Selects the units of EtCO2 measurement value , option : <**mmHg**> <**%**>.
VIEW TYPE	Selects the value displayed in the screen, options : <**$EtCO_2$**> <**$InsCO_2$**>.
EtCO2 HI	Selects $EtCO_2$ alarm upper limit, setup range : **0 ~ 13.1%(99.9mmHg),** regulated continuously, not under lower limit.
EtCO2 LO	Selects $EtCO_2$ alarm lower limit, setup range : **0 ~ 13.1% (99.9mmHg),** regulated continuously, not under upper limit.
Offset CAL	Offset Calibration. Choose offset calibration manner. Options included: <**AUTO**>, <**MANU**>. Please preserve the default configuration <**AUTO**> in normal measuring.

START PUMP	Press this button to start sampling pump, Begin measuring $EtCO_2$.
STOP PUMP	Press this button to stop sampling pump, Stop measuring $EtCO_2$.
OFFSET CAL	Carry out offset calibration based on the selected manners.
GAIN CAL	Carry out gain calibration.

Caution: When the machine starts, the default configuration of pump in the $EtCO_2$ module is off. Please start sampling pump if $EtCO_2$ need surveying. Close the sampling pump when measurement has been finished, since long-playing racing of sampling pump can shorten the life of $EtCO_2$ module.

Note: To prolong the life time of IRMA ETCO2, you should remove IRMA ETCO2 sensor for the monitor after monitoring is finished.

5.7.3 Gain Calibration

- Please carry out gain calibration and manual offset calibration, when the following conditions happened:

  1) The module has been used for between half a year and one year.

  2) The precision of EtCO2 reading has been doubted by clinical physician.

  3) After the latest calibration, atmospheric pressure or height above sea level varies evidently.

The apparatus has already been calibrated before leaving factory. User can directly apply it to measuring in normal conditions, to the exclusion of the previous conditions.

Gain calibration and manual offset calibration must be carried out if the previous conditions happened. The following procedures must be observed:

1. In parameter setup, please adjust <**VIEW TYPE**> of the $EtCO_2$ module to $InsCO_2$;

2. When the monitor has been run for 30 minutes, one end of the sampling tube has been connected with the module, the other end has been exposed in the undefiled atmosphere , please adjust <**OFFSET CAL**> **(Offset Calibration)** to **MANU (Manual)** in the $EtCO_2$ setup dialog box, and press the button of **OFFSET CAL** to start offset calibration.

Please connect the adjusting device according to Fig.5-7-3. While the standard gas of pressure CO_2 5.0% (38.0mmHg) getting across the sampling tube, observe pressure

measuring apparatus carefully to ensure that the pressure of standard gas is one standard atmosphere (the range of error is ±5%). Then press the **GAIN CAL**（**Gain Calibration**）of $EtCO_2$ parameter setup dialog box, a password input box will emerge. Please input the password to start gain calibration. About five seconds later, the reading having calibrated will be shown in the screen.

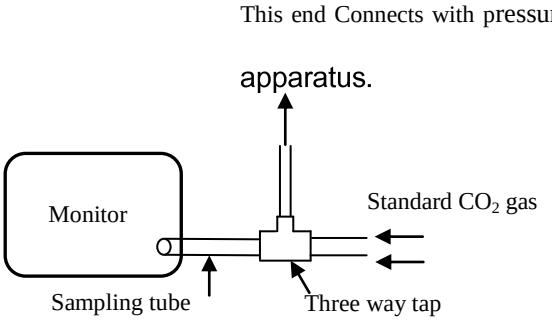


Fig.5-7-3 Gain calibration sketch map

Warning: The standard gas of which the pressure of CO_2 is 5.0%（38.0mmHg）must be used during gain calibration. Otherwise, measurement values will not be accurate.

Advice: User may only calibrate the device under the instruction of the technical personnel authorized by company. Moreover, wrong calibrating procedure may result in false reading.

5.8 Measurement of Mainstream EtCO2

The measurement of mainstream EtCO2 of M69 monitor can only uses PHASEIN IRMA mainstream multi-gas probe provided by Biolight Co., Ltd.

5.8.1 Preparatory Steps for Measurement of mainstream EtCO2

1）Plug the IRMA connector into the IRMA input socket on the back panel of the monitor.

2)Snap the IRMA sensor head on top of the IRMA airway adapter. It will click into place when properly seated.

3) A yellow LED indicates that the IRMA sensor is ready for use.

4) Connect IRMA/airway adapter 15 mm male connector to the breathing circuit Y-piece.

5）Connect the IRMA/airway adapter 15 mm female connector to the patient's endotracheal tube.

5.8.2 Pre-use check

Perform the tightness check of the patient circuit with the IRMA sensor head snapped on the IRMA airway adapter.

Check that the connections have been made correctly by verifying an actual CO2 waveform on the monitor display.

5.8.3 calibration

Following the instructions to calibrate an IRMA probe:

1. Disconnect the IRMA sensor from the airway adapter.
2. Wait until the LED starts blinking with red light.
3. Snap the IRMA sensor back on the airway adapter.
4. Check that the LED turns yellow.

5.8.4 Setup of EtCO2 parameters

Select <**EtCO2**> button in **System Menu**, then will present a screen as follow (Fig. 5-8-4). We can set the EtCO2 parameters.

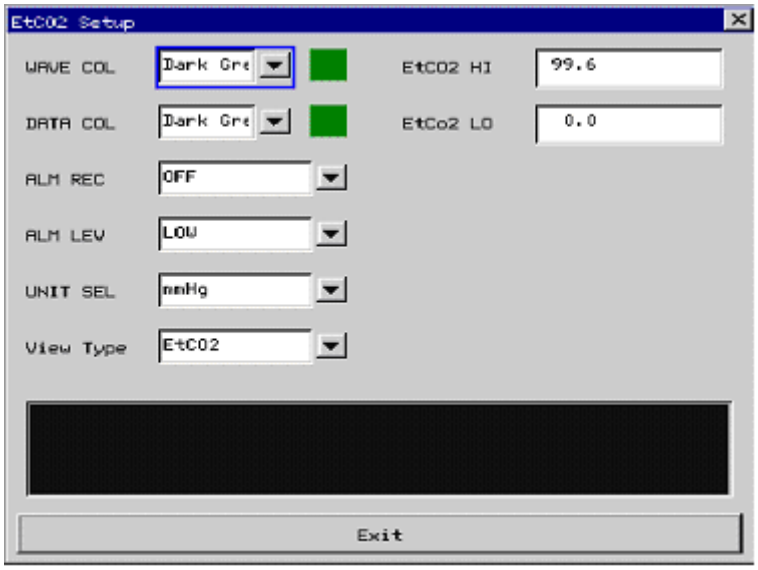


Fig.5-8-1 Setup of EtCO2 parameters

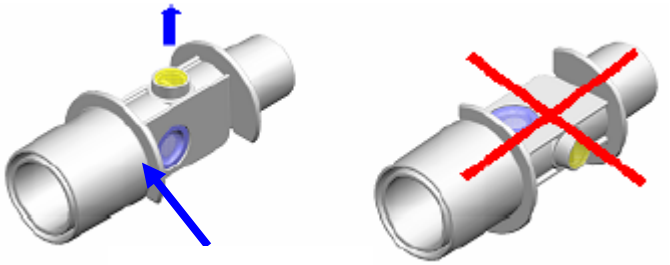
WAVE COL	Selects the color of waves of EtCO2 displayed in the screen.
DATA COL	Selects the color of data of EtCO2 displayed in the screen.
ALM REC	Selects <**ON**> to open the warning print of EtCO2 data, the detail is the introduction of warning print. Selects <**OFF**> to close the warning print of EtCO2 data.
ALM LEV	Set EtCO2 parameters' alarm level, there are four levels: <**OFF**>, <**LOW**>, <**MID**>, <**HIGH**>.
UNIT SEL	Selects the units of EtCO2 measurement value , option : <**mmHg**> <**%**>.
VIEW TYPE	Selects the value displayed in the screen, options : <**$EtCO_2$**> <**$InsCO_2$**>.
EtCO2 HI	Selects $EtCO_2$ alarm upper limit, setup range : **0 ~ 13.1%(99.9mmHg),** regulated continuously, not under lower limit.
EtCO2 LO	Selects $EtCO_2$ alarm lower limit, setup range : **0 ~ 13.1% (99.9mmHg),** regulated continuously, not under upper limit.

Caution: To prolong the life time of IRMA ETCO2, you should remove IRMA EtCO2 sensor for the monitor after monitoring is finished.

5.8.5 Precautions during Measurement

1. Plus IRMA probe into the EtCO2 socket on the back panel of the monitor, then connect IRMA/airway adapter to the breathing circuit Y-piece. After the monitor is powered up, and it functions normally with the EtCO2 module indicator light turns yellow. The IRMA EtCO2 module is ready for use and there is no need to start the sample pump.
2. Do not place the IRMA airway adapter between the ET tube and an elbow, as this may allow patient secretions to block the adapter windows.

3. To keep secretions from pooling on the windows, position the IRMA airway adapter with its windows in a vertical position and not in a horizontal position.



Measuring window

4. To prevent “rain-out” and moisture ,from draining into the IRMA airway adapter, do not place the airway adapter in a gravity dependent position.
5. Do not use the IRMA airway adapter with nebulized medications as this may affect the light transmission of the airway adapter windows.
6. Never sterilize or immerse the IRMA sensor in liquid.
7. Do not apply tension to the sensor cable.
8. Do not operate the device at temperatures less than 10℃(50℉) or greater than 35℃ (95℉).
9. If error occurs in IRMA sensor, the indicate light will keep in red, and blink in red means the sensor is check the airway adapter.

10. Use a piece of clean cloth and alcohol for IRMA EtCO2 cleaning.

Chapter 6 Alarm

This chapter gives general information about the alarm and corresponding remedies.

Note: The equipment generates all the audio and optical alarms through speaker, LED and screen.

6.1 Alarm Level

There are three kinds of alarms, defined as physiological, technical and general. Physiological alarms refer to those alarms triggered by patient's physiological situation which could be considered dangerous to his or her life, such as SpO2 exceeding alarm limit (parameter alarms). Technical alarms refer to system failure, which can make certain monitoring process technically impossible or make monitoring result unbelievable. General alarm belongs to those situations that cannot be categorized into these two cases but still need to pay some attention. Each alarm, either technical or physiological, has it's own level. Some alarm's level can be set by the user, others can not be changed once defined by the system.

Alarms in the monitor are divided into three levels, that is: high, medium and low.

- High-level alarm indicates the patient's life is in danger or the monitor under using has serious problem in technical respect. It is the most serious alarm.
- Medium-level alarm means serious warning.
- Low-level alarm is a general warning.

Only alarm level of parameters exceeding limits alarm can be modified by the user, the other alarm levels of physiological, technical and general alarms are preset by the system and they can not be changed by the user.

6.2 Alarm Modes

When alarm occurs, the monitor may raise the user's attention in two ways, which are audio prompt, visual prompt and description. Visual prompt is given by screen of the monitor, audio prompt is given by speaker in the device. Physiological alarm is displayed in the Physiological Alarm area. Most of technical alarms are displayed in the Technical Alarm area. Technical alarms related to NIBP measurement are displayed in the NIBP parameter area.

The Physiological Alarm area is on the upmost right part of the screen. The

Technical Alarm area is to the left side of the Physiological Alarm area.

NOTE: The concrete presentation of each alarm prompt is related to the alarm level.

Alarm Sound

The high/medium/low-level alarms are indicated by the system in following different audio ways:

Alarm level	Audio prompt
High	Mode is "DO-DO-DO------DO-DO, DO-DO-DO------DO-DO", which is triggered once every 10 seconds.
Medium	Mode is "DO-DO-DO", which is triggered once every 25 seconds.
Low	Mode is "DO-", which is triggered once every 25 seconds.

Screen Display

Physiological alarm: The parameter, which triggers the alarm, splashes in the frequency of 2Hz on the screen. The physiological alarm description area on the lower right of the screen displays alarm message, and red "***" indicates high-level alarm, yellow "**" indicates medium-level alarm, yellow "*" indicates low-level alarm. When Technical alarm or General alarm occurs, the Technical alarm description area provides text prompt, red "***" indicates high-level alarm, yellow "**" indicates medium-level alarm, yellow "*" indicates low-level alarm, cyan indicates general message.

Note: When alarms of different levels occur at the same time, the monitor prompts the one of the highest level.

6.3 Alarm Setup

Set alarm limits of physiological parameters

The alarm limit of each physiological parameter can be set in its menu, and they are continuous in alarm range. For example:

ECG alarm setup:

Step one: Select Menu <ECG>

Step two: Configure the following parameters related to ECG alarm, <Alarm LEV>, <HR LO> and <HR HI>.

Please refer to above operation for Methods of Alarm setup of the other parameters

It is important to set physiological alarm limits properly. The monitor can't give medicinal alarm prompt in clinical application with improper setting of physiological alarm limit.

The physiological alarm occurs when the measurement exceeds the set parameter limits.

Please refer to above operation for Methods of alarm setup of the other parameters

▭ **Set Alarm volume**

Step one: Select <ALM VOL> item in Menu: <MAIN> → <System Info…> → <Volume Setup…>.

Step two: Set <ALM VOL> item to <Off>, <1>, <2> or <3>.

The key of <**Alarm** > on the front panel is also used to adjust whether voice can be emitted when alarm happened.

Press <**Alarm**> key once, alarm voice will be prohibited.

Press <**Alarm**> key again, alarm voice will be allowed.

If alarm voice prohibited, the icon will be displayed in the right undersurface of the screen.

▭ **Alarm indication of physiological parameters**

Audio: when alarm occurs, the system generates alarm sound to raise the user's attention (audio alarm can be disabled).

Visual: The parameter flashes on the display area of the screen and alarm LED lights.

warning：**The lower limit and the upper limit of parameter must be set based on clinical practices and general clinical experiences.**

Note：**When parameter alarm level is off, alarm will abate, even if the measurement results exceed the limitation. Alarm LED in the front of the device will alarm at the highest level, if different levels alarms coexist.**

6.4 Alarm Cause

Alarm of the monitor includes:

1. Physiological Alarm
2. Technical Alarm
3. General Alarm and Prompt

▭ Physiological Alarm

When the measuring value has exceeded the set parameter limit and its <ALM LEV> is not <OFF>, the Monitor alarms. The monitor wouldn't alarm with absence of either of the two conditions.

▭ System Alarm (Belongs to Technical Alarm)

Once system fault occurs, the monitor will alarm immediately and trigger

corresponding operations, such as stop displaying values and waveforms, erase the last screen to avoid misleading. The screen displays more than one fault message by alterative.

- General Alarm and Prompt

  Sometimes there are alarms similar to Technical Alarms but can be considered as normally. The condition, which triggers this kind of alarm wouldn’t bring danger to the patient.

Chapter 7 Print

The print function of Multi-Parameter Monitor has been realized by a built-in recorder.

When monitor hasn't been equipped with a recorder, the icon will be displayed in the right undersurface of the screen.

When monitor has been equipped with a recorder, the icon will be displayed in the right undersurface of the screen.

Alarm Print

Multi-Parameter Monitor provides the function of alarm trigger print. To make alarm print available, Please keep <**RECORDER SETUP**> of <**System Info**> in **<Main>** menu is <**ON**>, and adjust alarm level of alarm parameter to non-close. If any monitoring parameter exceeds the limitation and <**ALM REC>** is <**ON>**, recorder will print all monitoring parameter values in the alarm time. Moreover, if monitor alarms continuously, recorder will print every other two minutes and mark alarm parameter in character. The specific meanings are shown in the following:

"HR-HIGH"	Heart Rate is too high.
"HR-LOW"	Heart Rate is too low.
"SPO_2-HIGH"	SpO_2 is too high.
"SPO_2-LOW"	SpO_2 is too low.
"PR-HIGH"	Pulse Rate is too high.
"PR-LOW"	Pulse Rate is too low.
"RR-HIGH"	Respiration Rate is too high.
"RR-LOW"	Respiration Rate is too low.
"Apnea"	Apnea.
"T1-HIGH"	Temperature 1 is too high.
"T1-LOW"	Temperature 1 is too low.
"T2-HIGH"	Temperature 2 is too high.
"T2-LOW"	Temperature 2 is too low.
"NSYS-HIGH"	Systolic pressure of NIBP is too high.
"NSYS-LOW"	Systolic pressure of NIBP is too low.
"NDIA- HIGH"	Diastolic pressure of NIBP is too high.
"NDIA--LOW"	Diastolic pressure of NIBP is too low.
"NMEAN-HIGH"	Mean pressure of NIBP is too high.
"NMEAN-LOW"	Mean pressure of NIBP is too low.
"ISYS1-HIGH"	Systolic Pressure of Invasive Blood Pressure 1 is too high.

"ISYS1-LOW"	Systolic Pressure of Invasive Blood Pressure 1 is too low.
"IDIA1-HIGH"	Diastolic Pressure of Invasive Blood Pressure 1 is too high.
"IDIA1-LOW"	Diastolic pressure of Invasive Blood Pressure 1 is too low.
"IMEAN1-HIGH"	Mean Pressure of Invasive Blood Pressure 1 is too high.
"IMEAN1-LOW"	Mean Pressure of Invasive Blood Pressure 1 is too low.
"ISYS2-HIGH"	Systolic Pressure of Invasive Blood Pressure 2 is too high.
"ISYS2-LOW"	Systolic Pressure of Invasive Blood Pressure 2 is too low.
"IDIA2-HIGH"	Diastolic Pressure of Invasive Blood Pressure 2 is too high.
"IDIA2-LOW"	Diastolic Pressure of Invasive Blood Pressure 2 is too low.
"IMEAN2-HIGH"	Mean Pressure of Invasive Blood Pressure 2 is too high.
"IMEAN2-LOW"	Mean Pressure of Invasive Blood Pressure 2 is too low.
"$EtCO_2$-HIGH"	$EtCO_2$ is too high.
"$EtCO_2$-LOW"	$EtCO_2$ is too low.

AUTO Print

Multi-Parameter Monitor provides the function of periodic print. To make Periodic print available, operator can adjust **<AUTO REC>** (periodic print) of <**Recorder Setup**> of <**System Info**> in **<Main>** menu to a necessary interval time. All monitoring parameter values will be printed automatically according to the determined period.

Note：The <ALM REC> is included in any parameter setup menu. If the option of print control is at <OFF>, the waveforms and data of individual parameter can only be printed in the ECG analysis screen or trend observation screen.

Real-Time Record

Multi-Parameter Monitor provides the function of real time recording. If <**RECORD**> key in the front panel has been pressed, the waveform and data of cardiac electro and SPO_2 can be recorded in real time. If <**REORD**> pressed again, real time recording will end. The lead ECG waveform (determined by <**LEAD SEL**> in <**ECG Setup**>) will be monitoring in emphasis, when ECG waveforms are being recorded.

During real time recording, three waveforms can be noted at the same time. When there is a lack of Invasive Blood Pressure module in the monitor, the three waveforms are respectively ECG、SpO_2、respiration wave. Otherwise, the three waveforms are respectively ECG , SpO_2、the first IBP waveform. Measurement parameter values of individual module have been recorded on the top of waveforms.

Print screen

Multi-Parameter Monitor provides the function of print screen. Presses the <**FREEZE**> key in the front panel to freeze waveforms, then presses the <**PRINT**> key, the waveforms displayed in the screen will be printed orderly. Even if the <**FREEZE**> has been canceled immediately, print screen will continues. However, other bed monitoring screen, Respiration oxygenation graph screen and capital character screen cannot be printed**.**

Chapter 8 The Maintenance and Cleaning

8.1 System Check

An effective maintenance schedule should be established for your monitoring equipment and reusable supplies. This should include inspection as well as general clearing on a regular basis. The maintenance schedule must comply with the policies of your institution's infection control unit and/or biomed department.

Check with your Biomedical department to be sure preventive maintenance and calibration has been done. The User Maintenance Instruction contains detailed information.

Before using the monitor, check the equipment following these guidelines:

- Check the equipment for obvious mechanical damage.
- Check all the outer cables, inserted modules and accessories for fraying or other damage. Qualified service personnel should repair or replace damaged or deteriorated cables.
- Check all the functions relevant to patient monitoring, make sure that the monitor is in good condition.

If you find any damage on the monitor, stop using the monitor on patient, and contact the biomedical engineer of the hospital or Manufacturer's Customer Service immediately.

Note: Refer to the User Maintenance Instruction for more comprehensive checkout procedures.

The overall check of the monitor, including the safety check, should be performed only by qualified personnel once every 6 to 12 month, and whenever the monitor is fixed up.

- Inspect the safety relevant labels for legibility.
- Verify that the device functions properly as described in the instructions for use.
- Test the protection earth resistance according IEC 601-1:1988, Limit 0.2ohm.
- Test the earth leakage current according IEC 601-1:1988, Limit: NC 500uA, SFC 1000uA.
- Test the patient leakage current according IEC 601-1:1988, Limit: 100uA(BF), 10uA(CF).
- Test the patient leakage current under single fault condition with mains voltage on

the applied part according IEC 601-1:1988, Limit: 5mA(BF), 50uA(CF).

The leakage current should never exceed the limit. The data should be recorded in an equipment log. If the device is not functioning properly or fails any of the above tests, the device has to be repaired.

The synchronism of the defibrillator should be checked by in the frequency described in the hospital regulations. At least every 3 months, it should be checked by the biomedical engineer of the hospital or qualified service technician.

All the checks that need to open the monitor should be performed by qualified service technician. The safety and maintenance check can be conducted by persons from the manufacturer. You can obtain the material about the customer service contract from the local office.

The circuit diagrams, parts lists and calibration instructions of the patient monitor can be provided by the manufacturer.

Warning: If the hospital or agency that is responding to using the monitor does not follow a satisfactory maintenance schedule, the monitor may become invalid, and the human health may be endangered.

Note: To ensure maximum battery life, please ensure that the battery is always fully charged when you are keeping the device in storage for an extended period of time, and check the battery status at least once every month and recharge the battery.

Warning: Refer the battery replacement only to manufacturer's service technician.

8.2 Battery Maintenance

A built-in rechargeable and maintenance-free battery is designed for Patient Monitor, which enables continuous working when AC power off. Special maintenance is not necessary in the normal situation. Please pay attention to the followings in using for more durable usage and a better capability.

- Operate the patient monitor in the environment according to the instruction.
- Use AC power for the patient monitor when available.

▭ Recharge the battery sooner when it is off. The volume of battery will not be charged to what it should be, when the battery has not been charged for a long time.

▭ Recharge the battery for every half a year when the patient monitor is not operated for a long period.

▭ Avoid exposed and sun shine.

▭ Avoid infrared and ultraviolet radiation.

▭ Avoid moist, dust and erosion from acid gas.

8.3 General Cleaning

Warning: Before cleaning the monitor or the sensors, make sure that the equipment is switched off and disconnected from the power line.

The Patient Monitor must be kept dust-free.

Regular cleaning of the monitor shell and the screen is strongly recommended. Use only non-caustic detergents such as soap and water to clean the monitor shell.

Please pay special attention to the following items:

1. Avoid using ammonia-based or acetone-based cleaners such as acetone.
2. Most cleaning agents must be diluted before use. Follow the manufacturer's directions carefully to avoid damaging the monitor.
3. Don't use the grinding material, such as steel wool etc.
4. Don't let the cleaning agent enter into the chassis of the system.
5. Don't leave the cleaning agents at any part of the equipment.

8.4 Cleaning Agents

Examples of disinfectants that can be used on the instrument casing are listed below:

- Diluted Ammonia Water
- Diluted Sodium Hypochlorite (Bleaching agent).

Note: The diluted sodium hypochlorite from 500ppm (1:100 diluted bleaching agent) to 5000ppm (1:10 bleaching agents) is very effective. The concentration of the diluted sodium hypochlorite depends on how many organisms (blood, mucus) on the surface of the chassis to be cleaned.

- Diluted Formaldehyde 35%--37%
- Hydrogen Peroxide 3%
- Alcohol 75%
- Isopropanol 70%

The patient monitor and sensor surface can be cleaned with hospital-grade ethanol and dried in air or with crisp and clean cloth.

The manufacturer has no responsibility for the effectiveness of controlling infectious disease using these chemical agents. Please contact infectious disease experts in you hospital for details.

8.5 Sterilization

Sterilization needed for the following parts.

- **For cuff**
  1. To clean for normal hygienic purposes, wipe with a mild soap and water solution.
  2. Do not immerse in chemicals/ detergent or water. Accidental entry of liquid into the tubing or bladder can ultimately damage the monitor.
- **For IBP cable and sensor**
  1. After removal and disposal of a used dome, wipe the exposed surfaces of the baseplate with disinfectant such as 70% isopropyl alcohol prior to reuse of the baseplate.
  2. Do not use an abrasive or sharp instrument or material to clean sensor or diaphragm. Use of abrasive materials may damage sensor or diaphragm.
  3. Do not use quaternary cationic detergents such as zephiran chloride. If the whole unit is to be sterilized, immerse the transducer but not the electrical connector into the sterilant. Be sure that the dome is removed. Then rinse all transducer parts except the electrical connector with sterilized water or saline. The transducer must be thoroughly dried before storing.
- **For Temperature Probe**

Ethylene oxide is the preferred sterilization method, after sterilization, probes must be safely and thoroughly ventilated before handling or use. Using a generic EtO sterilizing procedure, we recommends an aeration time of 12 hours minimum to dissipate residual RtO in the probe below 250 ppm.

- **For SpO2 probe**
  1. Saturate a clean, dry gauze pad with the cleaning solution. Wipe all surfaces of the

sensor and cable with this gauze pad.

2. Saturate another clean, dry gauze pad with sterile or distilled water. Wipe all surfaces of the sensor and cable with this gauze pad.
3. Dry the sensor and cable by wiping all surfaces with a clean, dry gauze pad.

Do not sterilize by irradiation, steam, or ethylene oxide.

- **For ECG/RESP cable**

To avoid extended damage to the equipment, sterilization is only recommended when stipulated as necessary in the hospital maintenance schedule. Sterilization facilities should be cleaned first.

Recommended sterilization material:

Ethylate: 70% alcohol, 70% isopropanol

Acetaldehyde

No sterilization needed for ECG electrodes and other disposable parts.

Please pay special attention to the following items:

- **Do not let liquid enter the monitor.**
- **Do not pour liquid onto the monitor during sterilization.**
- **Use a moistened cloth to wipe up any agent spilled on the monitor.**

8.6 Disinfection

To avoid extended damage to the equipment, disinfection is only recommended when stipulated as necessary in the Hospital Maintenance Schedule. Disinfection facilities should be cleaned first.

Appropriate disinfection materials for ECG lead, SpO2 sensor, blood pressure cuff, TEMP probe, IBP sensor are introduced in the corresponding chapters respectively.

Warning: Do not use EtO gas or formaldehyde to disinfect the monitor.

Appendix A Notes on Code of the NIBP Error Information

Error code	Causes of troubles
E02	Errors of sensors or other hardware.
E06	a. The cuff is not tightly tied. b. The cuff is not connected. c. Adult cuff is used for Child or Neo.
E07	Air valve, air tube or cuff leaks air
E08	Pressure error, unable to maintain stable cuff pressure, such as snarl of air tube
E09	a. The cuff is too loose. b. The pulse of patient is too weak.
E10	Exceed measurement range.
E11	a. The patient moves frequently during measurement. b. Severe vibration occurs during measurement. c. Irregular pulse rate, such as arrhythmia.
E12	Pressure of cuff exceeds safety limits, for Adult mode it is 315mmHg, Child mode is 255mmHg, Neonate mode is 170mmHg. If the patient suddenly sneezes or touches the cuff during measurement, such measurement errors may occur.
E13	Signal saturation.
E14	Air valve leaks.
E15	System failure.
E19	Measurement exceeds time limit, the maximum is, for Adult mode, less than 120 seconds, Child and Neonate mode less than 90 seconds.

Appendix B Default system setup

There are three options of default system setup: ADULT, CHILD, NEONATAL. The followings are the detail:

1．General setup (It is same in ADULT、CHILD and NEONATAL default system setup.)

1）System Setup

Work-Screen	Standard Screen
Sweep Speed	25mm/s
KEY VOL	OFF
SYS VOL	1
ALM VOL	1
AUTO REC	OFF
ALM REC	OFF
PARA of trend graph	HR
INTERVAL of trend graph	1 min
INTERVAL of trend table	1 min

2）ECG Setup

WAVE COL	Green
DATA COL	Magenta
ALM REC	OFF
ALM LEV	LOW
LEAD TYPE	Keep the last selection
LEAD SEL	Keep the last selection
GAIN SEL	10mm/mv
MODE SEL	MON

3）NIBP Setup

DATA COL	Write
ALM REC	OFF
ALM LEV	LOW

UNIT SEL	mmHg
Age	ADULT
Mode	MANU
INTER	3 min

4）SpO2/PR Setup

WAVE COL	Red
DATA COL	Red
ALM REC	OFF
ALM LEV	LOW

5）RESP Setup

WAVE COL	Azure
DATA COL	Azure
ALM REC	OFF
ALM LEV	LOW
Sweep Speed	25mm/s
Gain	2x
Apnea	0s
RESP RES	ECG

6）TEMP Setup

DATA COL	Yellow
ALM REC	OFF
ALM LEV	LOW
UNIT SEL	℃

7）IBP Setup

WAVE COL	Cyan
DATA COL	Dark green
ALM REC	OFF
ALM LEV	LOW
UNIT SEL	mmHg
IBP1 VEIN SEL	ART

IBP1 RANGE SEL	AUTO
IBP2 VEIN SEL	ART
IBP2 RANGE SEL	AUTO

8）EtCO2 Setup

WAVE COL	Dark yellow
DATA COL	Dark yellow
ALM REC	OFF
ALM LEV	LOW
UNIT SEL	mmHg
View Type	EtCO2
Offset CAL	AUTO

2．Parameters alarm limit setup of adult

Parameter	**Low limit**	**High limit**
HR (bpm)	50	120
SpO2 (%)	90	100
PR (bpm)	50	120
RR (bpm)	8	30
T1 (℃)	36.0	39.0
T2 (℃)	36.0	39.0
NIBP SYS (mmHg)	90	160
NIBP DIA (mmHg)	50	90
NIBP MEAN (mmHg)	60	110
IBP1 SYS (mmHg)	90	160
IBP1 DIA (mmHg)	50	90
IBP1 MEAN (mmHg)	60	110
IBP2 SYS (mmHg)	90	160
IBP2 DIA (mmHg)	50	90
IBP2 MEAN (mmHg)	60	110
EtCO2 (mmHg)	20	40

3．Parameters alarm limit setup of child

Parameter	Low limit	High limit
HR (bpm)	75	160
SpO2 (%)	90	100
PR (bpm)	75	160
RR (bpm)	8	30
T1 (℃)	36.0	39.0
T2 (℃)	36.0	39.0
NIBP SYS (mmHg)	70	120
NIBP DIA (mmHg)	40	70
NIBP MEAN (mmHg)	50	90
IBP1 SYS (mmHg)	70	120
IBP1 DIA (mmHg)	40	70
IBP1 MEAN (mmHg)	50	90
IBP2 SYS (mmHg)	70	120
IBP2 DIA (mmHg)	40	70
IBP2 MEAN (mmHg)	50	90
EtCO2 (mmHg)	20	40

4．Parameters alarm limit setup of neonate

Parameter	Low limit	High limit
HR (bpm)	90	200
SpO2 (%)	80	95
PR (bpm)	90	200
RR (bpm)	30	100
T1 (℃)	36.0	39.0
T2 (℃)	36.0	39.0
NIBP SYS (mmHg)	40	90
NIBP DIA (mmHg)	20	60
NIBP MEAN (mmHg)	25	70
IBP1 SYS (mmHg)	40	90
IBP1 DIA (mmHg)	20	60
IBP1 MEAN (mmHg)	25	70
IBP2 SYS (mmHg)	40	90

IBP2 DIA (mmHg)	20	60
IBP2 MEAN (mmHg)	25	70
EtCO2 (mmHg)	20	40